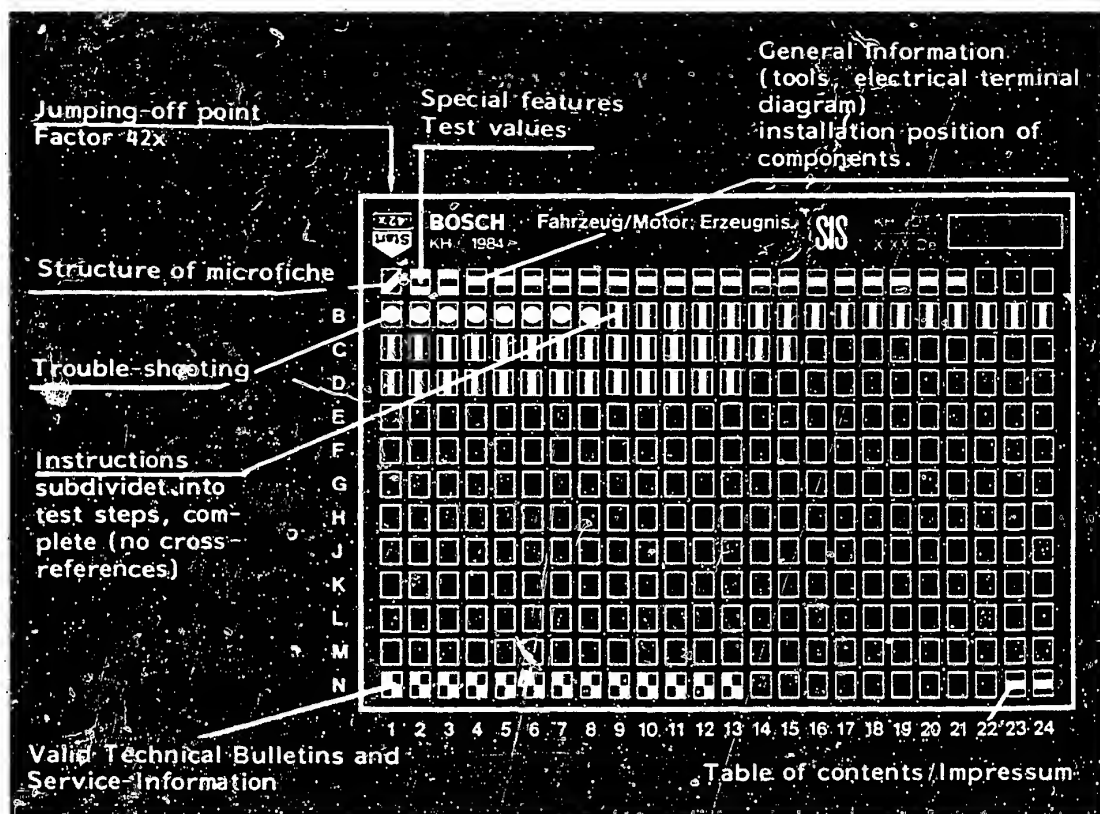


Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

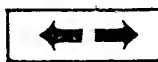
E16	Product/component/test step
	Vehicle/engine

↑ Coordinate

3. Limits of section



Beginning



Mid-section



End



One-page section

4. References to relevant test steps in test specifications; coordinate e.g. C6

C6

A1

Trouble-shooting program



1. Special features

Vehicles are equipped with:

trigger box	0 227 100 124 (with current limitation)
ignition coil	1 227 020 009
timing-advance unit	0 227 921 009

2. Test specifications

Ignition coil, primary	0.6 ... 1.0 Ω
------------------------	----------------------

B11

Ignition coil, secondary	6.4 ... 11.1 k Ω
--------------------------	-------------------------

Basic ignition setting with engine idling	10° BTDC
--	----------

1000 min⁻¹

Engine oil > 60°C

Set value for engine idle
with manually-shifted

transmission	900...950 min ⁻¹
--------------	-----------------------------

with automatic transmission	800...850 min ⁻¹
-----------------------------	-----------------------------

Material switch > approx. 17°C	approx. 0 Ω
< approx. 17°C	∞ Ω

C5

Oil-temperature switch < approx. 65°C	approx. 0 Ω
> approx. 65°C	approx. ∞ Ω

C7**A2**Test specifications

Opel



Power supply
to trigger box
with engine idling

12...14 V

C13

Power supply
to ignition coil
with engine idling

≥ 10 V

D4

Power supply
to ignition pulse generator

≥ 10 V

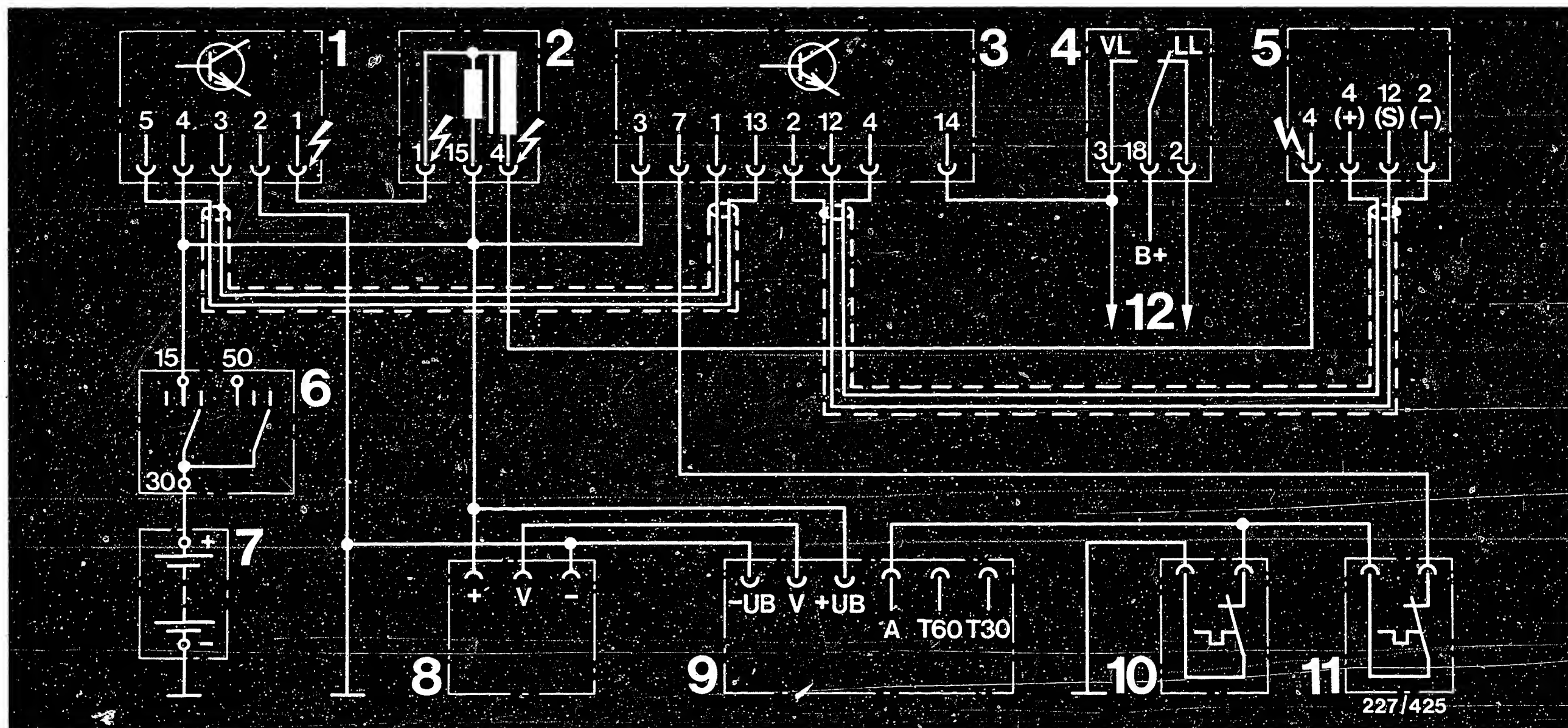
See Autodata test specifications for settings for
ignition, exhaust, valve clearance etc.

A3

Test specifications

Open





⚡ = Dangerous voltages (400 V - 25 kV)

3. Electrical terminal diagram

- 1 = Trigger box
- 2 = Ignition coil
- 3 = Timing-advance unit
- 4 = Throttle-valve switch
- 5 = Ignition distributor
- 6 = Ignition and starting switch

- 7 = Battery
- 8 = Distance pulse generator
- 9 = Speed switch
- 10 = Oil-temperature switch
- 11 = Material switch
- 12 = to L-Jetronic (version LE 2)

A4

Electrical terminal diagram
Opel



A5

Electrical terminal diagram
Opel



4. Installation position of components

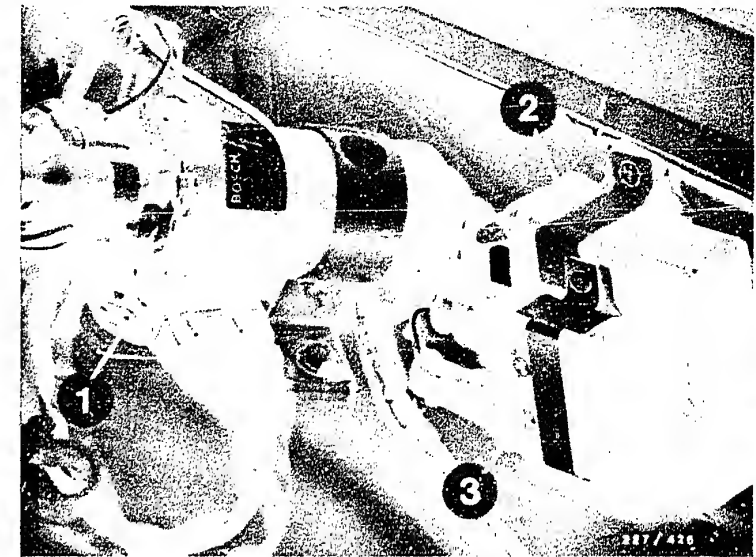
Trigger box and ignition coil are mounted on a common heat sink. See top picture.

Timing-advance unit and speed switch are situated next to the ignition coil. See top picture.

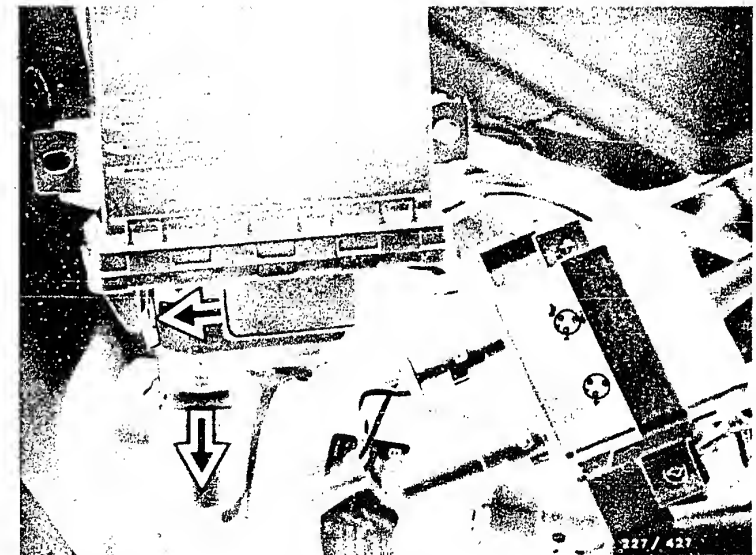
How to remove:

To disconnect the timing-advance unit plug, it is necessary to remove battery and timing-advance unit.

Press timing-advance unit plug detent in direction of arrow, then pivot plug in direction of arrow. See bottom picture.



- 1 = Trigger box
- 2 = Timing-advance unit
- 3 = Speed switch



A6

Installation position of components

Open

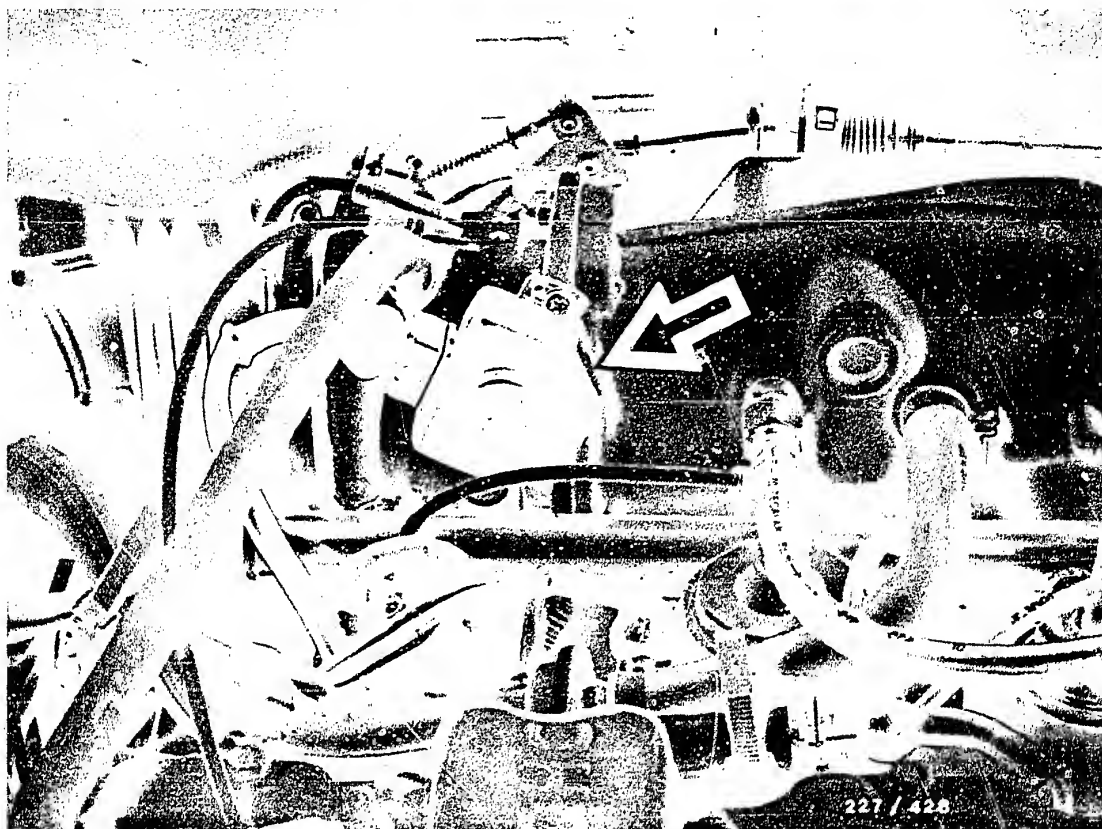


A7

Installation position of components

Open

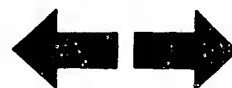


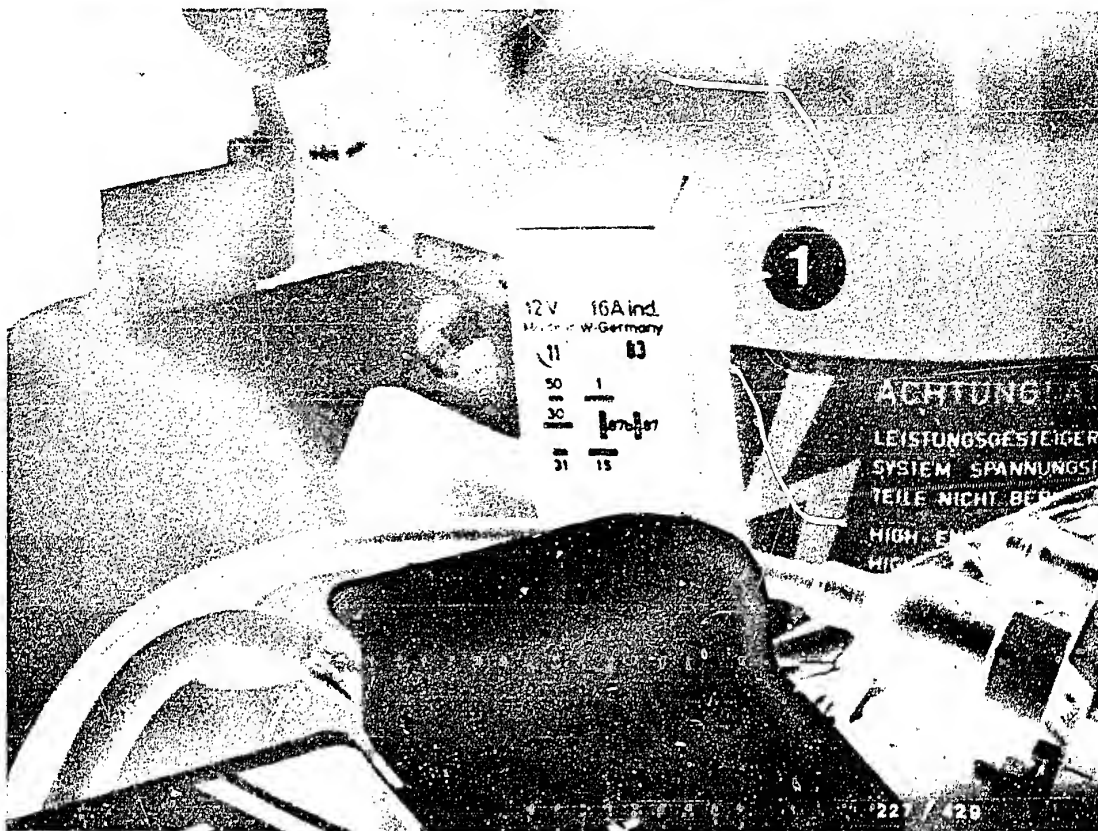


Arrow = Throttle-valve switch

A8

Installation position of components
Opel





1 = Control relay for L-Jetronic - version LE 2

A9

Installation position of components

Opel





- 1 = Material switch
- 2 = Material switch plug

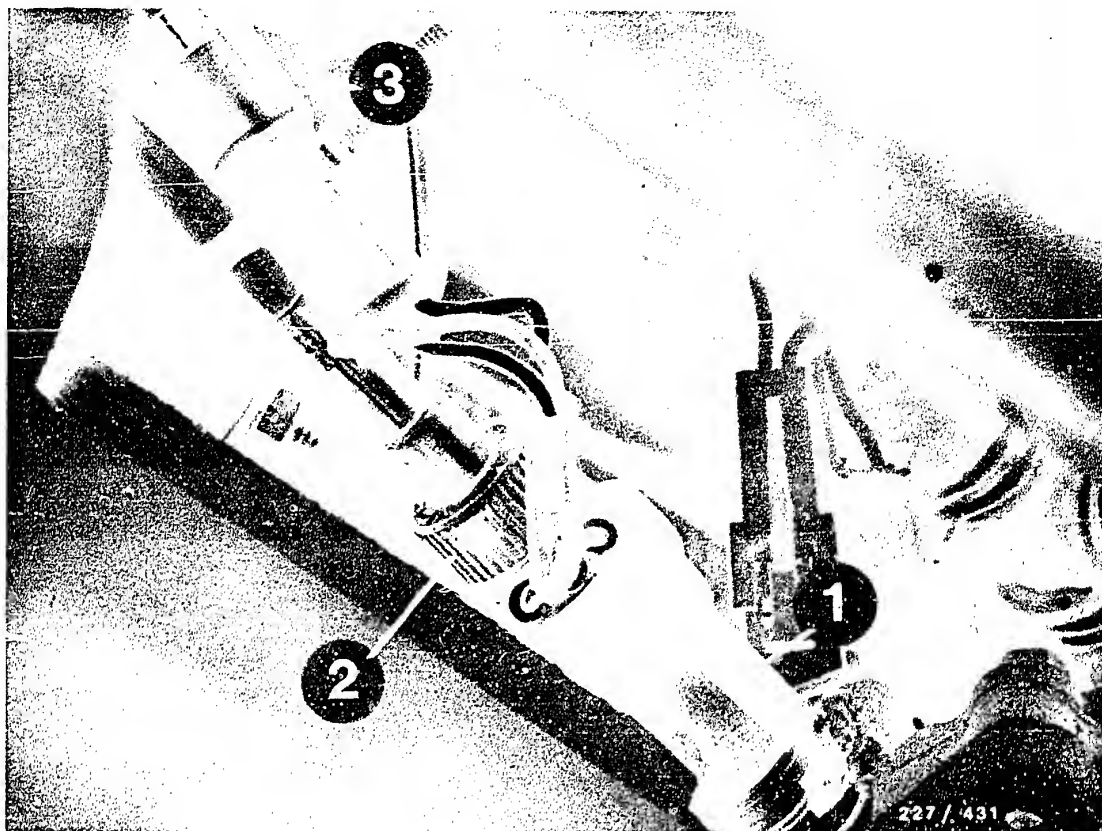
The material switch is situated on the intake manifold (bottom). See picture.

A10

Installation position of components

Opel





- 1 = Distance pulse generator
- 2 = Speedometer shaft connection
- 3 = Distance pulse generator plug

The distance pulse generator is situated at the speedometer shaft connection (transmission). See picture.



5. Necessary test equipment, aids

Motortester e. g.	MOT 201	0 684 000 201
Spark gap e. g. ignition coil and condenser tester or single spark gap	EFAW 106 A EF 1177/7	0 681 100 001 1 684 531 000
5 k Ω sleeve-type suppressor		0 356 500 001
Ohmmeter	ETE 014.00	0 684 101 400
or e. g.	Pontavi Wh2	commercially available
Voltmeter e. g.	ETE 014.00	0 684 101 400
Thermal conduction paste		5 942 860 003
Test prods		commercially available
2 auxiliary cables for user-fabrication, each consisting of approx. 90 mm cable 1.5 m ²		6 210
4 blade terminals e. g.		8 784 480 011



6. Danger of accident on electronic ignition systems

Increased demands of modern engines on the ignition system combined with the desire for freedom of maintenance have recently led to electronic ignition systems being fitted as standard. Usually the ignition power of electronic systems (of almost all manufacturers) is higher than that of conventional systems, and there are signs of further increases in power. Electronic ignition systems thus reach a power range which can be highly dangerous if live parts of terminals are touched (both on the primary as well as the secondary sides).

In this connection we should like to point out that the VDE regulations, in particular VDE 0104/7.67 and/or the respective national regulations must be followed when testing or working on the ignition system.

The ignition should always be switched off when working on the ignition system (switch off ignition or voltage source). Such work includes:

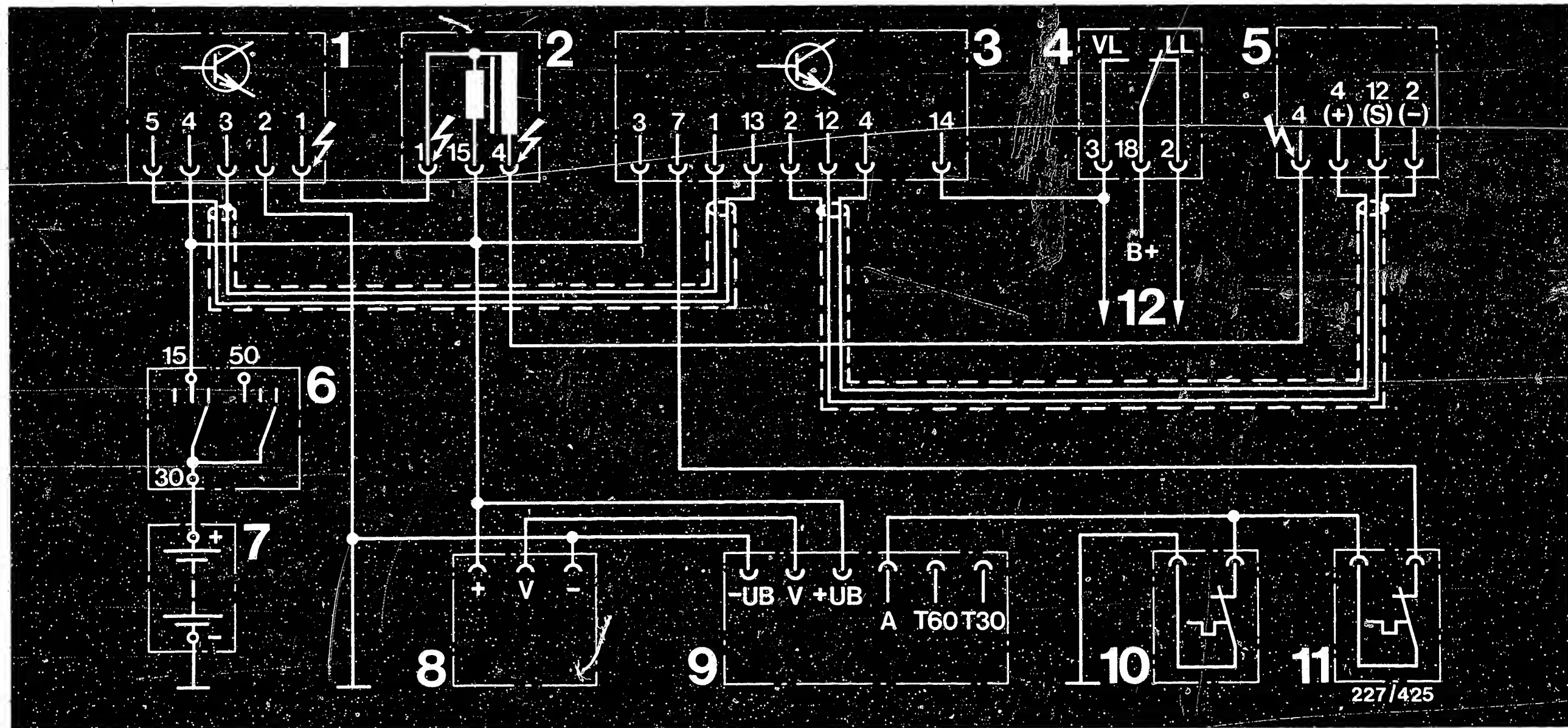
- Connecting of engine test equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacing parts of the ignition system (spark plug, ignition coil, ignition distributor, ignition cable etc.).



If, while testing the ignition system or during adjustment work on the engine (e. g. L-Jetronic) , it becomes necessary to switch on the ignition (switch on ignition or voltage source), the above-mentioned dangerous voltages occur over the entire system.

The danger of accident exists, therefore, not only on the individual assemblies of the ignition system (e. g. ignition distributor, ignition coil, trigger box, ignition harness), but also on the wiring harness (e. g. tachometer connection, diagnostic plug), at plug-in connections and test equipment.





⚡ = Dangerous voltage
(400 V - 25 kV)

1 = Trigger box
2 = Ignition coil
3 = Timing-advance unit

4 = Vacuum switch
5 = Ignition distributor
6 = Ignition/starting
switch

7 = Battery
8 = Distance-pulse
generator
9 = Speed switch

10 = Oil-temperature switch
11 = Water switch

Electrical terminal diagram The dangerous locations are identified by danger arrows taking the example of the terminal diagram of an electronic ignition system.

A15

Danger of accident

Open



A16

Danger of accident

Open



7. Incorrect indication of engine speed, dwell angle
and ignition point

In ignition systems with trigger box 0 227 100 124
(TZ) with current limitation there may be an incorrect
indication of engine speed, dwell angle and ignition
point on testers.

For further details see coordinates N 8 - N 12.

A17

Incorrect indication of testers

Opel



8. Important vehicle information

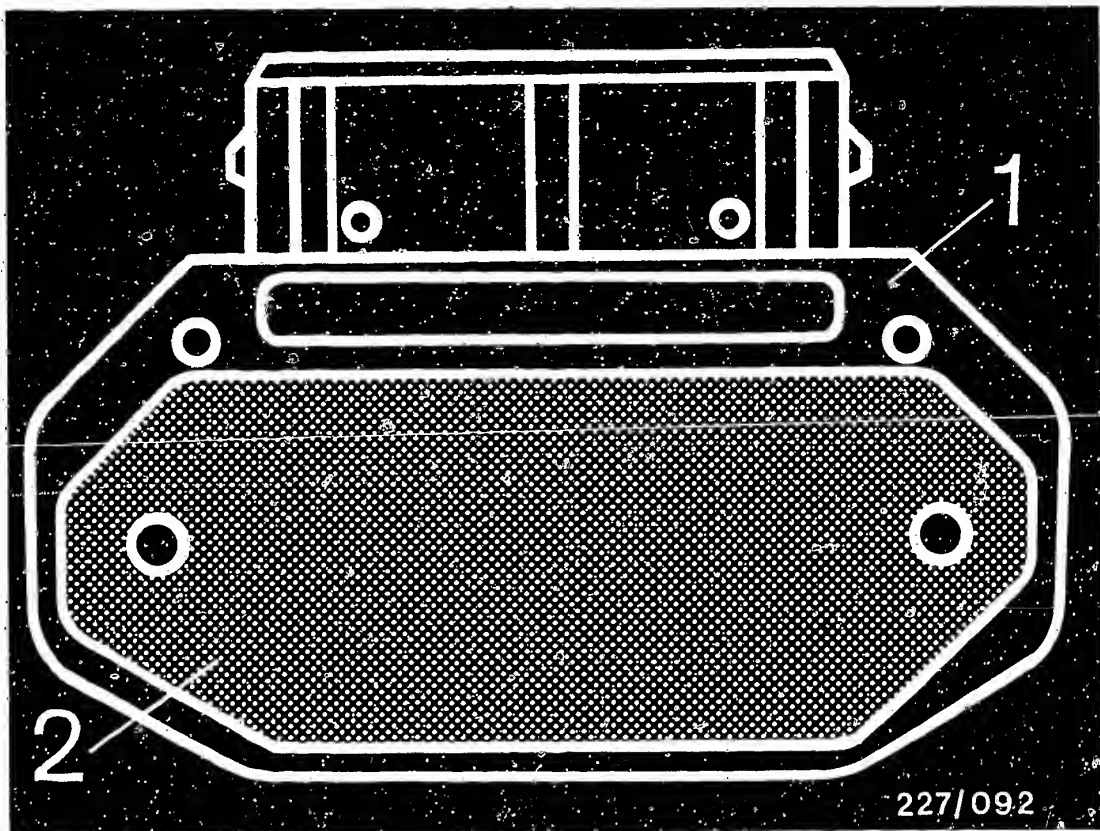
- Resistance measurements must only be performed with the ignition switched off or with the battery disconnected (measuring instrument defective).
- During the compression test, either pull off the trigger-box plug or f i r m l y connect terminal 4 of the ignition coil to ground using an extra cable (dangerous voltages, insulation damage at ignition coil, ignition distributor, ignition harness).

Note:

The extra cable must be suppressed with at least $2\text{ k } \Omega$, e. g. with sleeve-type suppressor ($5\text{ k } \Omega$) 0 356 500 001.

- The specified ignition coil (see Part No.) must not be replaced with a different ignition coil.
- No suppression capacitor must be connected to ignition coil terminal 1 and terminal 15.
- Ignition coil terminal 1 must not be brought into contact with ground as a theft-proofing measure (ignition coil will be destroyed when ignition is switched on).
- No battery + or test lamp must be connected to ignition coil terminal 1 (trigger box will be destroyed).
- Ignition cable from ignition coil terminal 4 to ignition distributor terminal 4 must not be disconnected during operation.
- There must be no arcing from ignition coil terminal 4 to ignition coil terminal 1 and 15. The magnetic pick-up assembly and trigger box may be destroyed.





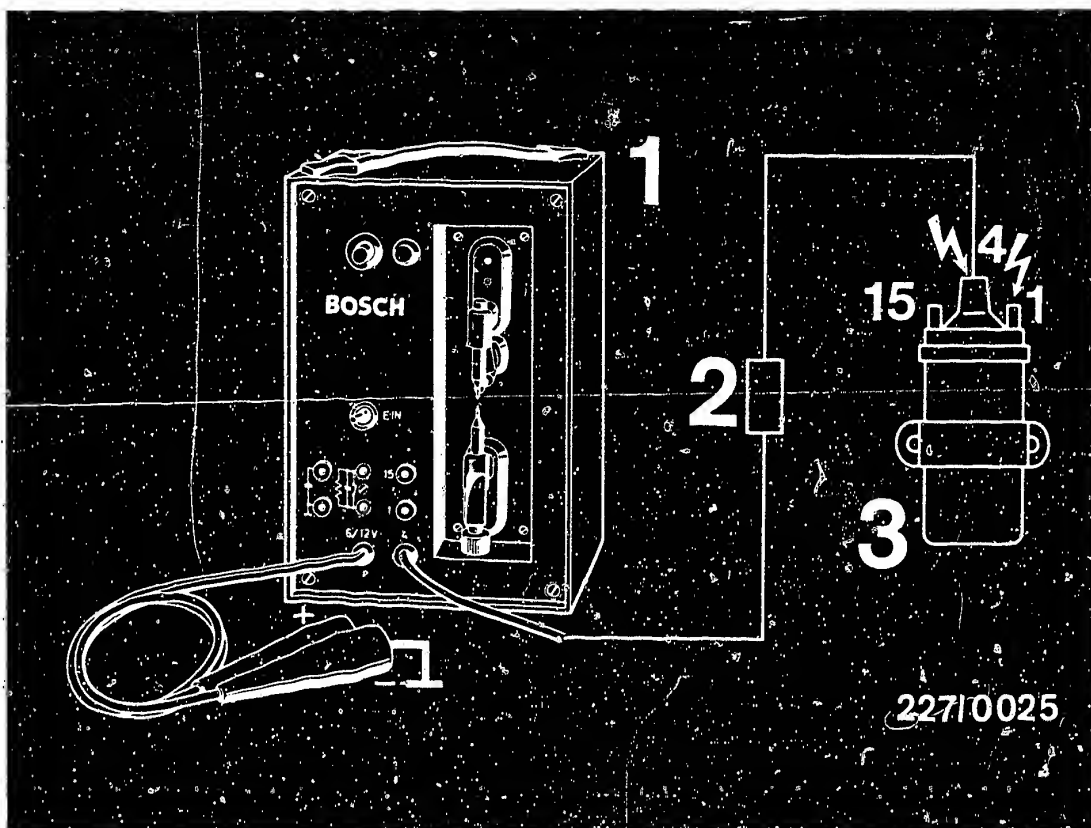
1 = Trigger box

2 = Base plate


- Before mounting the trigger box, the base plate must be coated with thermal conduction paste. Apply thermal conduction paste only with a suitable object (screwdriver, matchstick etc.)

Do not apply thermal conduction paste to painted parts.





- 1 = Spark gap
- 2 = 5 k Ω sleeve-type suppressor
- 3 = Ignition coil

 = dangerous voltages (400 V - 25 kV)

- In order to prevent the trigger box from being irreparably damaged, when using a spark gap, an interference-suppression resistor of at least 2 k Ω must be connected between the spark gap and ignition coil terminal 4, e. g. sleeve-type suppressor (5 k Ω) 0 356 500 001.



- In order to prevent the trigger box from being irreparably damaged, the secondary side of the ignition system must have at least 2 k Ω interference suppression whereby the original distributor rotor with 1 k Ω interference-suppression resistor must be fitted (even in the case of radio and spark interference suppression do not use a 5 k Ω distributor rotor).
- No external voltage, e. g. ohmmeter, must be connected to the ignition distributor magnetic pickup assembly (Hall generator).

Caution when switching over measuring ranges.

- The line from the Hall generator to the ignition timing unit and from the ignition timing unit to the trigger box must be shielded (malfunction of ignition timing unit/trigger box).
- The holding springs of the distributor cap must not drop into the pickup system when the engine is being cranked and with the dust-protection cover removed.
- Arcing or breakdown of insulation at the distributor cap (poor insulation) may lead to the destruction of the magnetic pickup assembly and trigger box.
- Do not disconnect battery with engine running.
- Incorrect battery polarity will lead to the destruction of the magnetic pickup assembly of the ignition distributor, trigger box and ignition coil as well as ignition timing unit.
- Do not use a starting aid with more than 16 V or a fast charger for starting.



9. Trouble-shooting program

9.1 Procedure - trouble-shooting chart

The trouble-shooting chart starting on Coordinate B 3 contains customer complaint (fault symptoms), cause of trouble, test instructions and coordinate reference.

The possible cause of the fault should be selected from the trouble-shooting chart in accordance with the customer complaint. (fault symptom).

If the cause of the fault is not clear, start testing with the detailed, self-contained trouble-shooting program beginning on Coordinate B 7.

If the cause of the fault is clear from the trouble-shooting chart, direct trouble-shooting is possible by going to the stated coordinate without having to perform the entire trouble-shooting program for each fault.

If there is no coordinate reference, trouble-shooting must be performed in accordance with the "Test instructions" column.

9.2 Procedure - trouble-shooting program

The trouble-shooting program starting on Coordinate B 9 is divided into 3 rows of boxes.

The left-hand row contains test instructions and test specifications.

The center row contains repair instructions.

The right-hand row contains the illustrations/terminal diagrams belonging to the text and the explanations of the items in the picture.

If the questions asked in the left-hand row can be answered conclusively with "yes", then proceed to the next test down.

9.3 Before testing, make sure of the following:

Battery fully charged, fuel system O.K., engine mechanically O.K. (e. g. compression, valve clearance etc.). Ambient temperature/ignition system temperature 0° to 100° C (temperature has a considerable effect on measured values).

B1

Trouble-shooting program

Open



B2

Trouble-shooting program

Open



9.4 Trouble-shooting chart

Customer complaint (fault symptom)

1. Starting motor operates, but engine fails to start

2. Rough idling

3. Poor throttle response

4. Engine lacks power

5. Misfiring

6. Fuel consumption too high

7. Engine pings when accelerating

8. Backfiring

9. Engine becomes too hot

										Cause of trouble	Test instructions	Coordinates
•	•	•	•	•	•	•	•	•	•	Unclear	Perform detailed trouble-shooting	B 19
•	•	•	•	•	•		•			Spark plugs defective	Evaluation by means of ignition oscilloscope, or visual examination of removed spark plug	-----
•	•	•	•	•						Shunt on secondary side	Evaluation of ignition coil, ignition distributor, ignition harness and spark plug by means of ignition oscilloscope or visual examination	-----
•	•	•	•	•						Open circuit on secondary side	Evaluation of ignition coil, ignition distributor, ignition harness and spark plug by means of ignition oscilloscope, or continuity test with ohmmeter	-----
•										Open circuit on primary side	---	D 1
•	•	•	•	•						Ignition coil defective	---	B 11
		•	•	•	•					Interference-suppression resistors defective	Evaluation by means of ignition oscilloscope or resistance measurement	-----

B3

Trouble-shooting program

Opel



B4

Trouble-shooting program

Opel



Trouble-shooting chart

Customer complaint (fault symptom)

1. Starting motor operates, but engine fails to start
2. Rough idling
3. Poor throttle response
4. Engine lacks power
5. Misfiring
6. Fuel consumption too high
7. Engine pings when accelerating
8. Backfiring
9. Engine becomes too hot

										Cause of trouble	Test instructions	Coordinates
●	●	●	●	●	●	●	●	●	●	Basic ignition setting incorrect	---	B 17
		●	●		●	●			●	Vacuum advance defective	See Autodata test specifications	---
			●		●					Control line for map control defective	---	B 19
			●		●					Distance pulse generator and speed switch defective	---	B 23
			●		●					Oil-temperature switch defective	---	C 5
			●		●					Material switch defective	---	C 7
			●		●					Throttle-valve switch defective	---	C 9

B5

Trouble-shooting chart

Opel



B6

Trouble-shooting chart

Opel



Trouble-shooting chart

Customer complaint (fault symptom)

1. Starting motor operates, engine fails to start

2. Rough idling

3. Poor throttle response (flat spot during acceleration)

4. Insufficient engine power

5. Misfiring

6. Fuel consumption too high

7. Engine pings when accelerating

8. Backfiring

9. Engine overheating

									<u>Cause of trouble</u>	<u>Test instructions</u>	<u>Coordinates</u>
•									Trigger box power supply defective	---	D 1
•									Ignition pulse generator defective	---	D3...D7
•									Timing-advance unit defective	---	D 8
•							•		Firing sequence incorrect	See Autodata test specifications	-----

B7

Trouble-shooting program

Opel



B8

Trouble-shooting program

Opel



9.5 Trouble-shooting program

yes

Test primary signal. If no oscilloscope or tachometer available, check whether ignition spark across spark gap.

Primary signal testing with oscilloscope

Connect oscilloscope to ignition coil as per operating instructions.

Start engine.

Oscilloscope must indicate a primary voltage (of any value).

Primary signal testing with tachometer

Connect tachometer to ignition coil as per operating instructions.

Start engine.

Tachometer must indicate a reading (of any value).

Ignition spark testing with spark gap

Remove H.T. igniton cable terminal 4 from ignition coil.

Connect spark gap including sleeve-type suppressor (5 k Ω) to ignition coil.

Adjust spark gap to 5 mm.

Start engine.

There must be sparks across the spark gap.

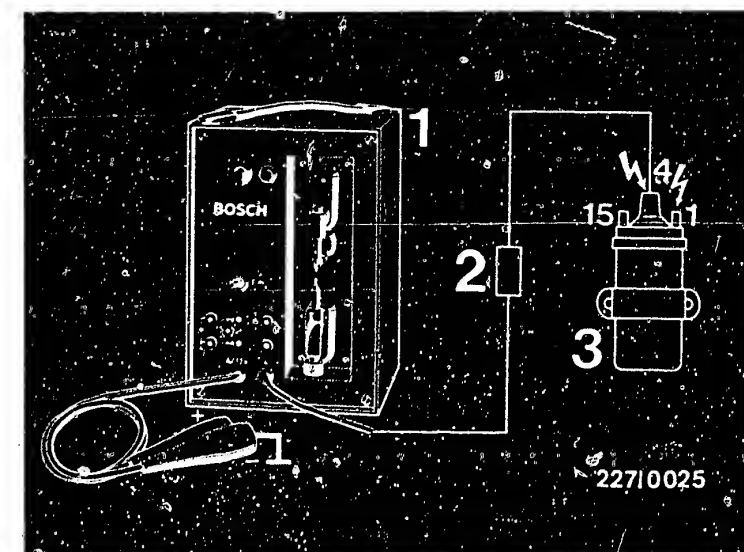
Primary signal present or ignition sparks across spark gap?

yes

Continued on B 11/B 12

If no primary signal or no ignition spark, continue testing at D 1.

Tests from B 11 onwards not necessary.



1 = Spark gap
2 = 5 k Ω sleeve-type suppressor
3 = ignition coil

⚡ = dangerous voltages
(400 V - 25 kV)

B9

Trouble-shooting program

Opel

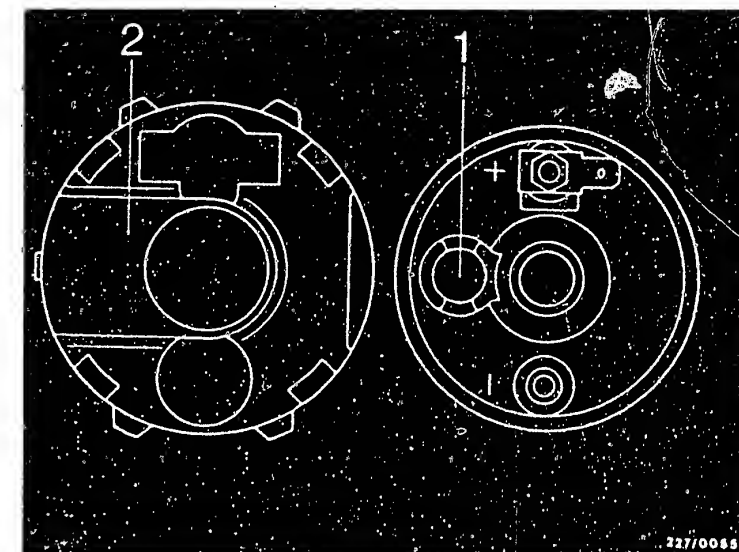
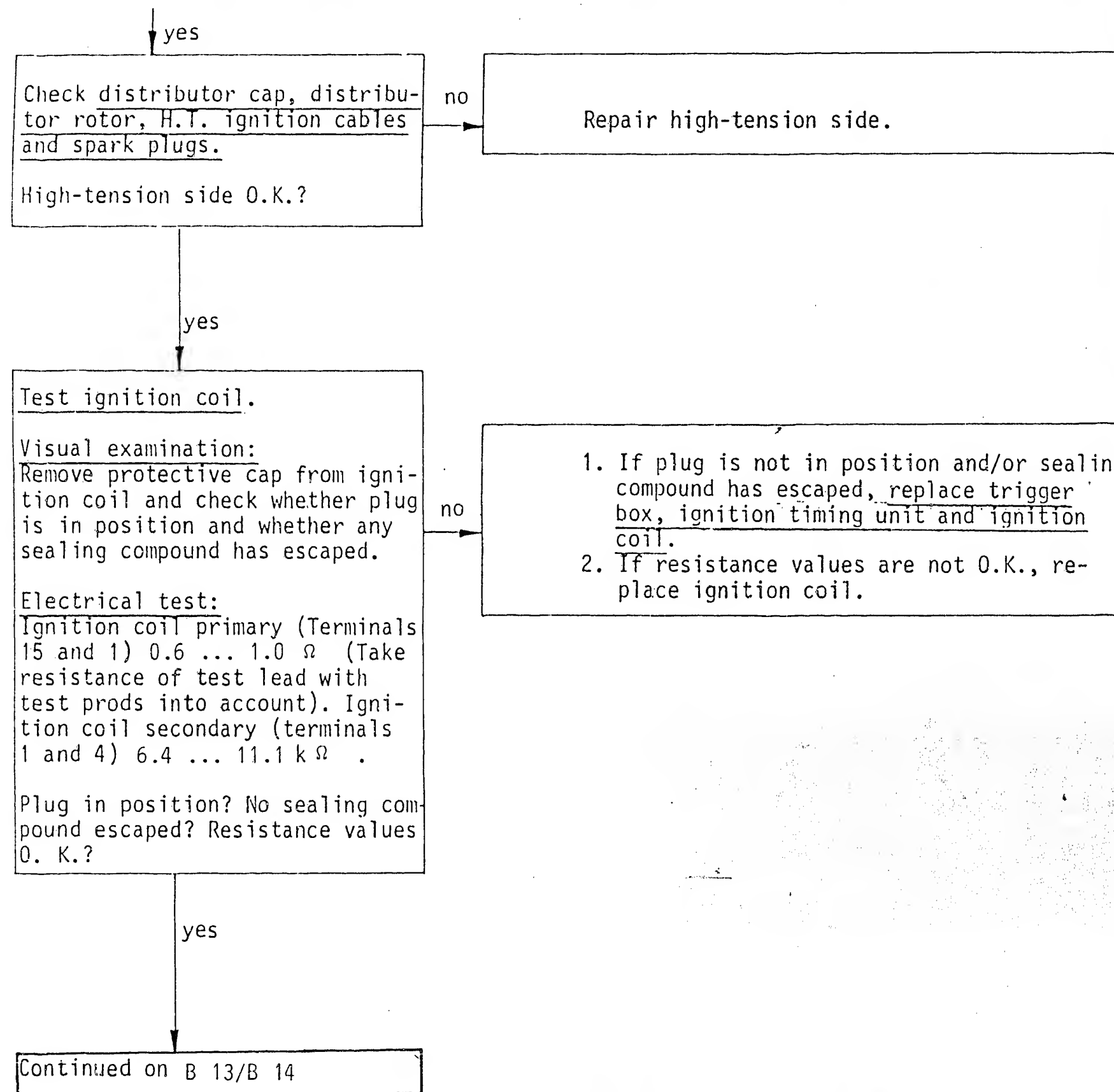


B10

Trouble-shooting program

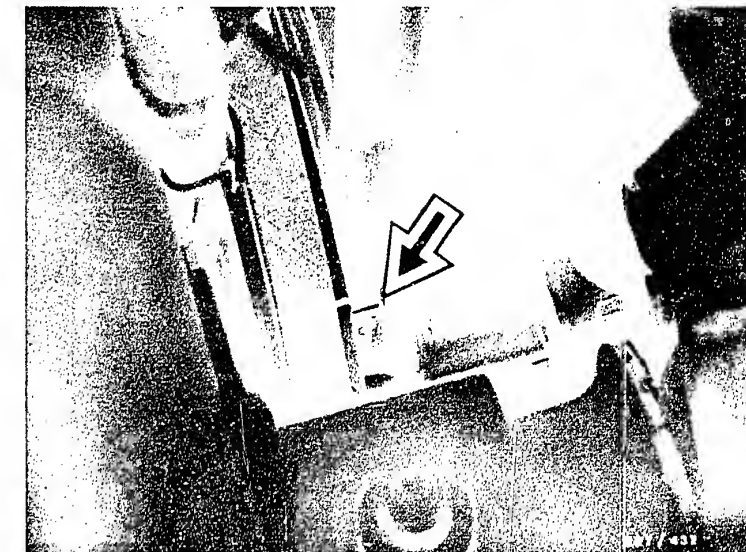
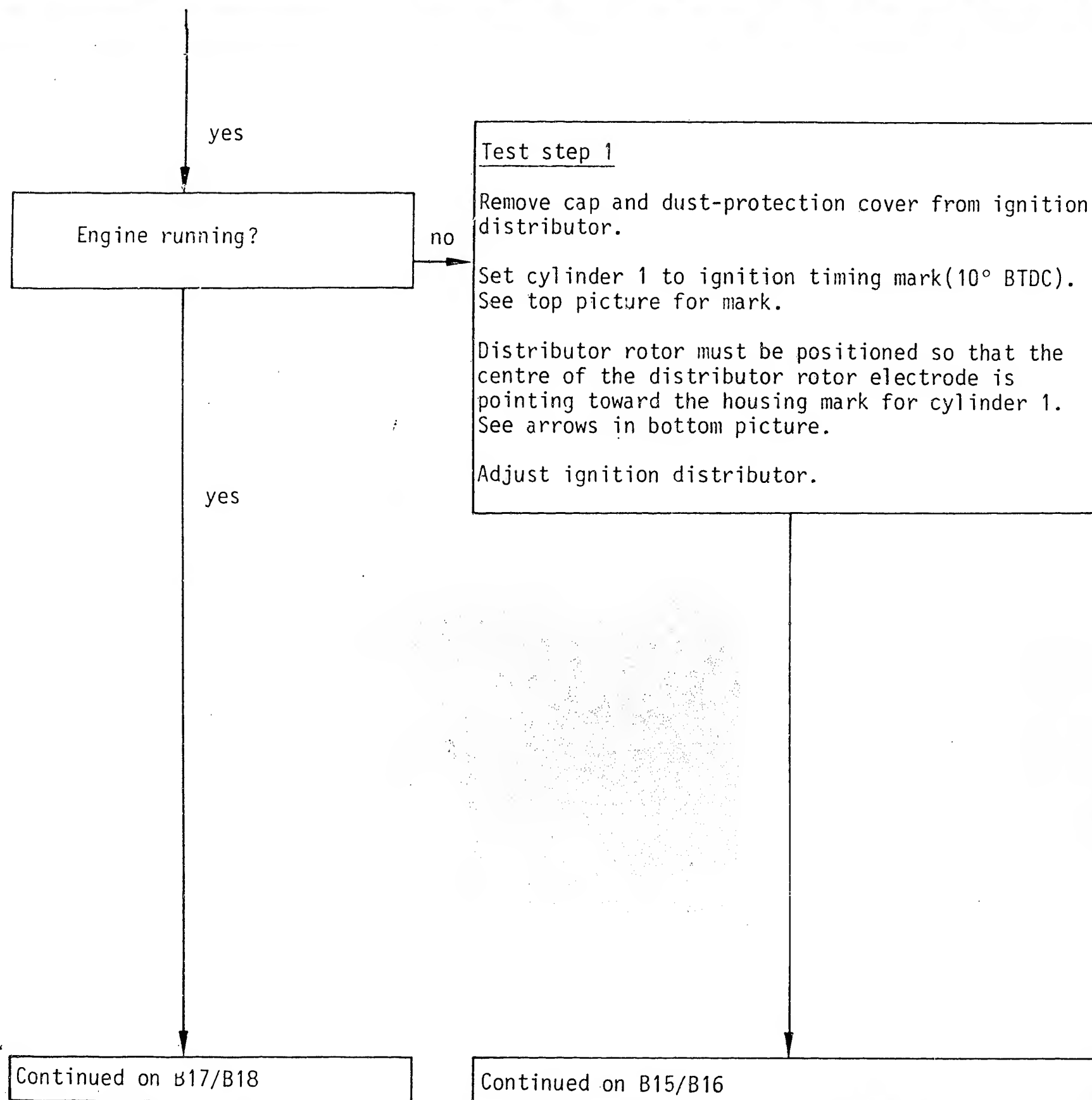
Opel





1 = Plug
2 = Protective cap





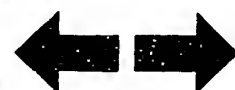
Arrow = Ignition timing mark
(8° BTDC)



B 13

Trouble-shooting program

Opel



B 14

Trouble-shooting program

Opel



Continued

Test step 2

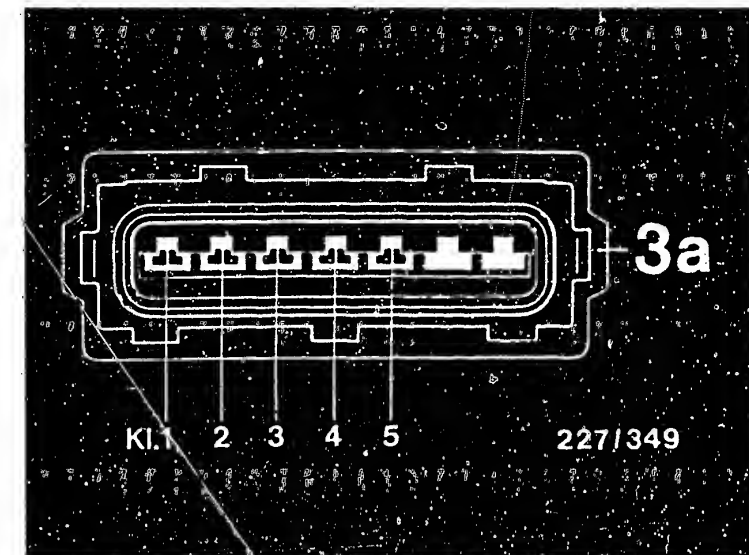
Disconnect negative and positive cables from battery. Disconnect trigger-box plug. Switch on ignition.

1. Test for contact resistance in leads from positive battery terminal to trigger-box plug term. 4 including leads from negative battery terminal to trigger-box plug term. 2. Total contact resistance max. 0.3Ω (take resistance of test lead with test prods into account). Eliminate contact resistance.
2. Test for contact resistance in leads from positive battery terminal to ignition coil term. 15 as well as in lead from ignition coil term. 1 to trigger-box plug term. 1. Total contact resistance max. 0.3Ω (take resistance of test lead with test prods into account). Eliminate contact resistance.

If test steps 1 and 2 O.K., renew trigger box.

yes

Continued on 317/B18



3a = Trigger-box plug

B 15

Trouble-shooting program

Open



B 16

Trouble-shooting program

Open



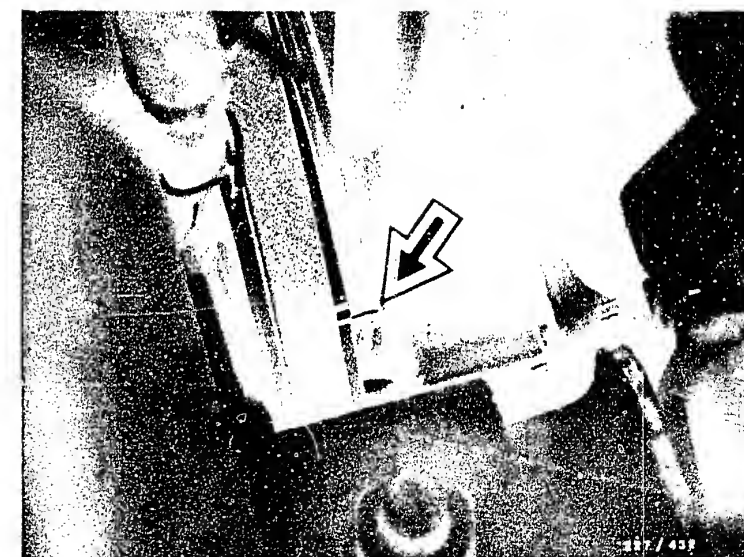
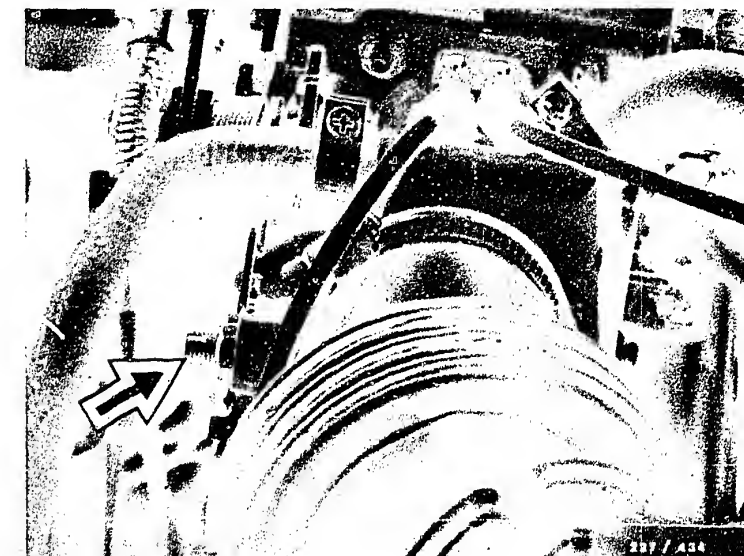
yes

Test basic ignition setting (if clearly incorrect reading of engine speed on testers, connect in series resistor). Bring engine to operating temperature (60°...80°C oil temperature). Switch off loads (lights etc.). Operate engine at idle. Caution: Idle speed must be below 1000 min⁻¹; turn idle-speed adjusting screw accordingly. See arrow in top picture. (Set value for engine idle with manually-shifted transmission 900...950 min⁻¹, with automatic transmission 800...850 min⁻¹). Flash timing light at ignition marks. Mark on crankshaft pulley must align with pointer. Mark corresponds to 10° BTDC. See arrow in bottom picture.

Basic ignition setting O.K.?

no

Loosen ignition-distributor mounting and turn ignition distributor until marks align. (10° BTDC).



Continued on B19/B20

B 17

Trouble-shooting program

Opel



B 18

Trouble-shooting program

Opel



yes

Test control line for map control

1. Disconnect material switch plug and bridge both plug connections with auxiliary cable. See arrow in top picture.

Press together speed switch plug by hand and disconnect plug. See arrow, bottom picture.

Connect plug term. A to ground using auxiliary cable. See bottom picture.

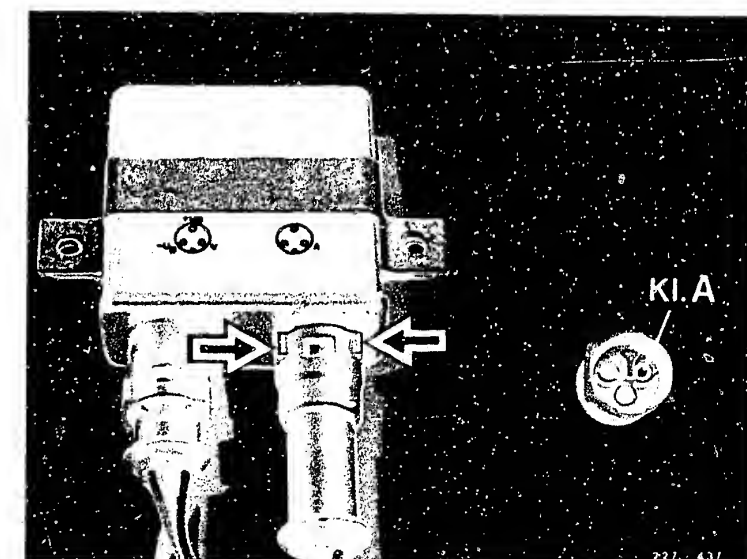
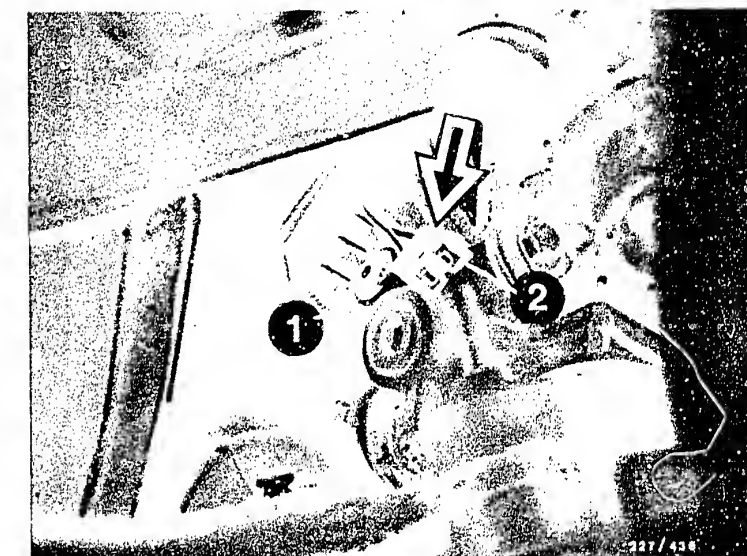
yes

Continued on B21/B22

B 19

Trouble-shooting program

Opel



B 20

Trouble-shooting program

Opel



yes

Remove battery and timing-advance unit.
Disconnect timing-advance unit plug.
See top picture.
Connect voltmeter to timing-advance unit plug
term. 3 (+) and term. 7 (-).

Re-connect battery.
Voltmeter must indicate approx. battery
voltage.

2. Remove auxiliary ground cable from speed
switch plug term. A.
See centre picture.

Bridge disconnected oil-temperature switch
plug using auxiliary cable.
See arrow, bottom picture.
Ignition on.
Voltmeter must indicate approx. battery
voltage.

Voltage in points 1 and 2 O.K.?

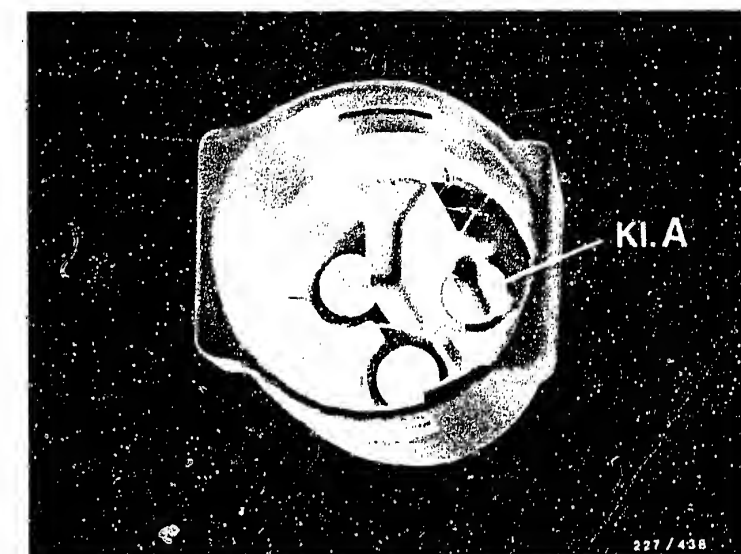
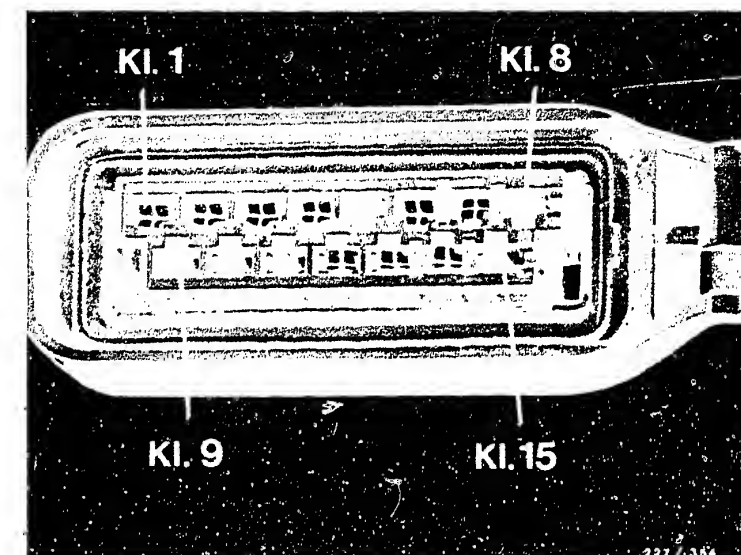
yes

Continued on B23/B24

no

If no voltage in point 1, test for
open circuit in lead from timing-
advance unit plug term. 7 (top
picture) through material switch plug
not shown) to speed switch plug
term. A (centre picture).
Eliminate open circuit.

If no voltage in point 2, test for
open circuit in lead from speed
switch plug term. A (centre picture)
to oil-temperature switch plug
(bottom picture) including its ground
connection.
Eliminate open circuit.



B21

Trouble-shooting program

Opel



B22

Trouble-shooting program

Opel



yes

Test distance pulse generator and speed switch.

1. Place vehicle on roller-type test stand, or lift up and place on 2 stands so that front wheels are free to turn. If on stands, secure vehicle (pull on handbrake, wedges under rear wheels).
Timing-advance unit connected. Speed switch plug disconnected. See arrow, top picture.

Connect voltmeter (-) with test prod to speed switch term. A and positive battery terminal. See top picture. Drive front wheels so that speedometer indicates approx. 20 km/h. Using additional cable, briefly connect term. A of speed switch to ground (cable must not remain on ground). Voltmeter must indicate approx. battery voltage.

2. Drive front wheels so that speedometer indicates 70...80 km/h. Voltmeter must now indicate approx. 7 ... 9 V.

Voltage in test steps 1 and 2 O.K.?

yes

Continued on C5/C6

no

1. Press together speed switch connection by hand - see arrows, bottom picture - and disconnect plug.

Connect voltmeter to speed switch plug term. +U_B and term. -U_B. See bottom picture.

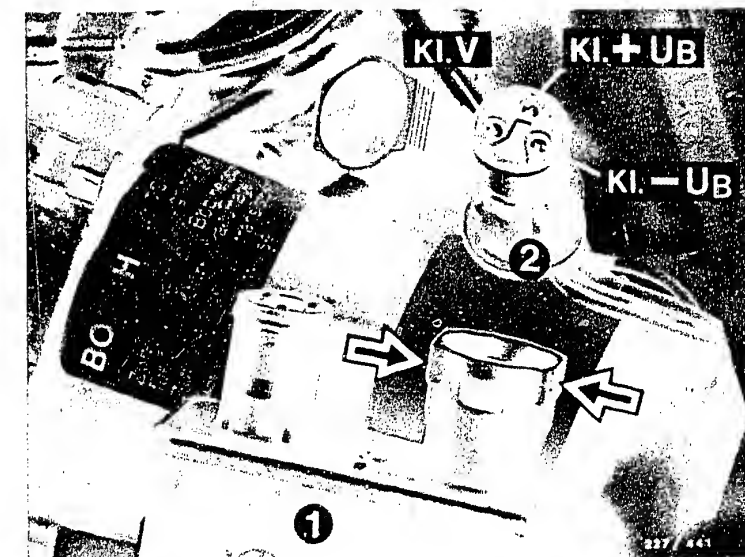
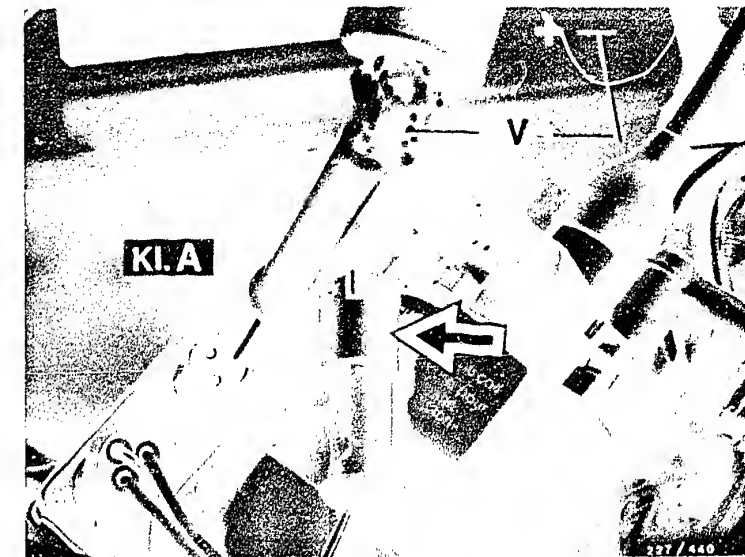
Switch on ignition.

Voltmeter must indicate battery voltage.

If battery voltage not indicated, test for open circuit in leads from speed switch plug term. +U_B and term. -U_B to ignition/starting switch term. 15 and battery negative.

Eliminate open circuit.

Continued on C1/C2



B 23

Trouble-shooting program

Opel



B 24

Trouble-shooting program

Opel



Continued

yes

2. Disconnect distance pulse generator plug.
See arrow, top picture.

Ignition on.

Connect voltmeter to distance pulse generator
plug term. + and term. -. See bottom picture.

Voltmeter must indicate battery voltage.

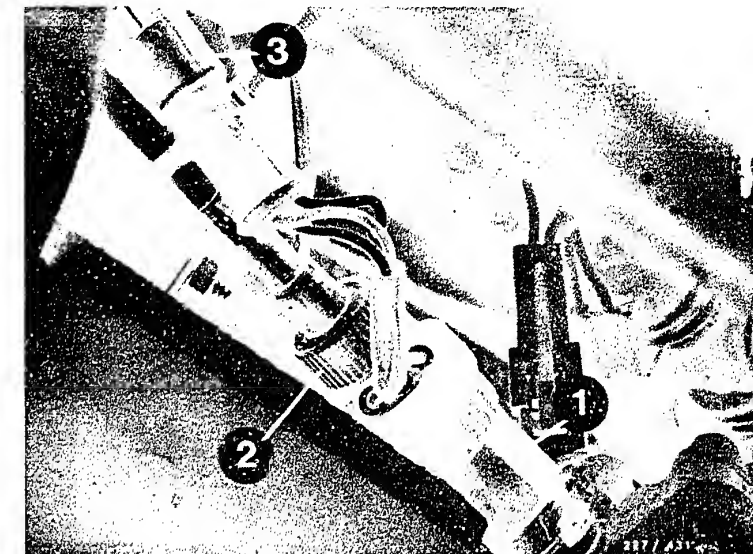
If battery voltage not indicated, test for open
circuit in leads from distance pulse generator
plug term. + and term. - to ignition/starting
switch term. 15 and battery negative.

Eliminate open circuit.

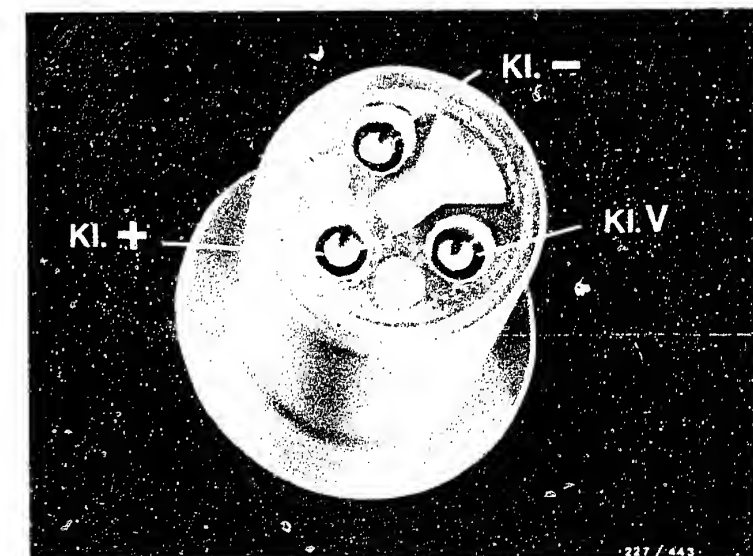
yes

Continued on C5/C6

Continued on C3/C4



1 = Distance pulse generator
2 = Speedometer shaft connection
Arrow = Distance pulse generator plug



C1

Trouble-shooting program

Open



C2

Trouble-shooting program

Open



Continued

yes

3. Connect distance pulse generator plug.
See top picture.

Connect dwell angle tester according to operating instructions:

For example MOT 201:
yellow clip to battery positive,
green clip with test prod to speed switch plug
term. V.
See bottom picture.

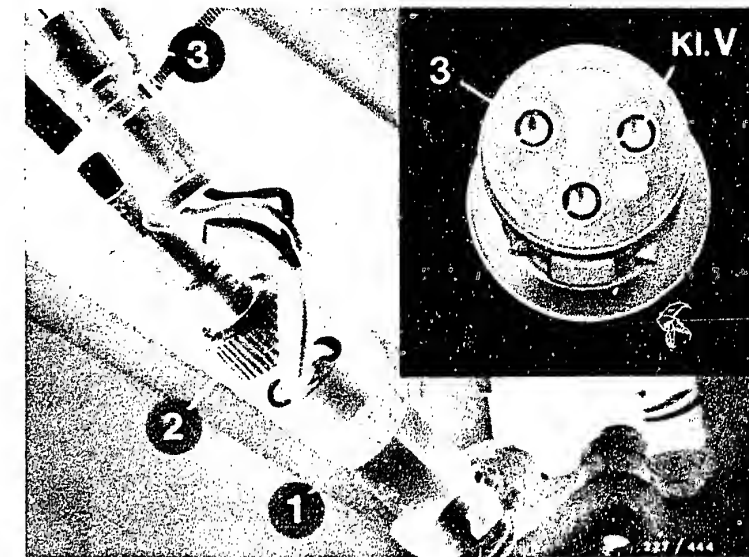
Drive front wheels at approx. 70...80 km/h.

Dwell angle tester must indicate approx. 45%.

If dwell angle reading O.K.,
renew speed switch.
See bottom picture.

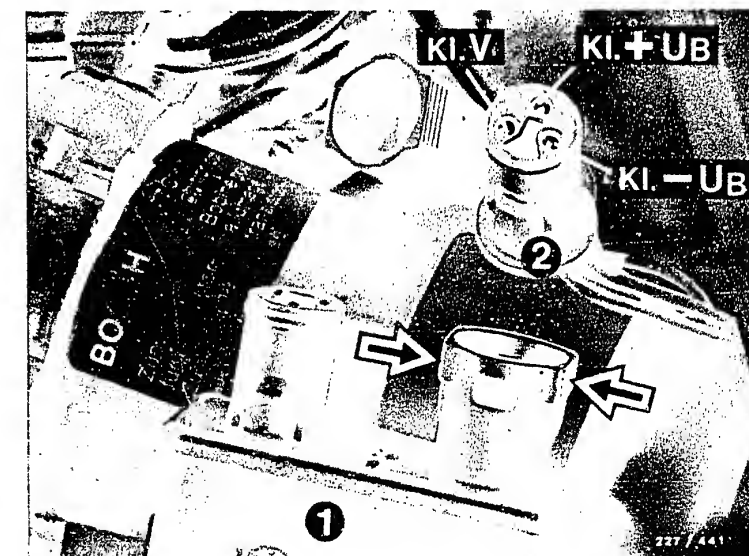
If dwell angle reading not O.K.,
test for open circuit in lead from speed switch
plug term. V to distance pulse generator plug
term. V.
Eliminate open circuit.

If there was no open circuit, renew distance
pulse generator.



- 1 = Distance pulse generator
- 2 = Speedometer shaft connection
- 3 = Distance pulse generator plug

- 1 = Speed switch
- 2 = Speed switch plug



Continued on C5/C6

C3

Trouble-shooting program

Opel



C4

Trouble-shooting program

Opel



yes

Test material switch

Material switch plug disconnected.

Connect ohmmeter to both terminals of material switch. See picture.

Ohmmeter reads as follows:

> approx. $+17^{\circ}\text{C}$ = approx. $0\ \Omega$
(switch closed)

< approx. $+17^{\circ}\text{C}$ = $\infty\ \Omega$
(switch open)

Resistance values O.K.?

no

Renew material switch.

yes

Continued on C7/C8



1 = Material switch
2 = Material switch plug

C5

Trouble-shooting program

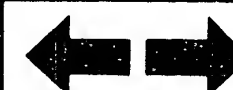
Opel



C6

Trouble-shooting program

Opel



yes

Test water switch.

Water switch plug disconnected.

Connect ohmmeter to both terminals of water switch.
See picture.

Ohmmeter shows the following readings:

> approx. 65°C = approx. 0 Ω
(switch closed)

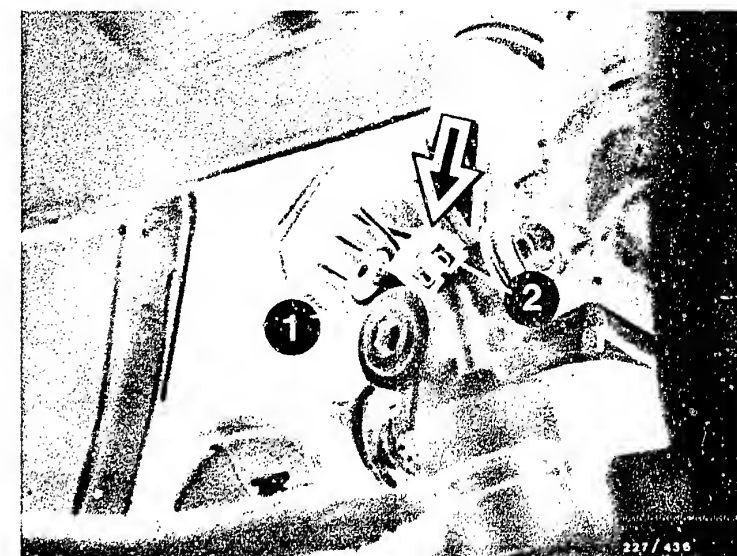
< approx. 65°C = ∞ Ω
(switch open).

Resistance value O.K.?

no Renew water switch.

yes

Continued on C9/C10



1 = Water switch
2 = Water switch plug

C7

Trouble-shooting program

Opel



C8

Trouble-shooting program

Opel



yes

Test throttle-valve switch (full-load contact).

Timing-advance unit plug disconnected.
Connect voltmeter to disconnected timing-advance unit plug term. 14 (+) and term. 1 (-).
See top picture.
Fully open throttle valve.
Briefly crank engine.
Voltmeter must indicate approx. battery voltage.

Voltage O.K.?

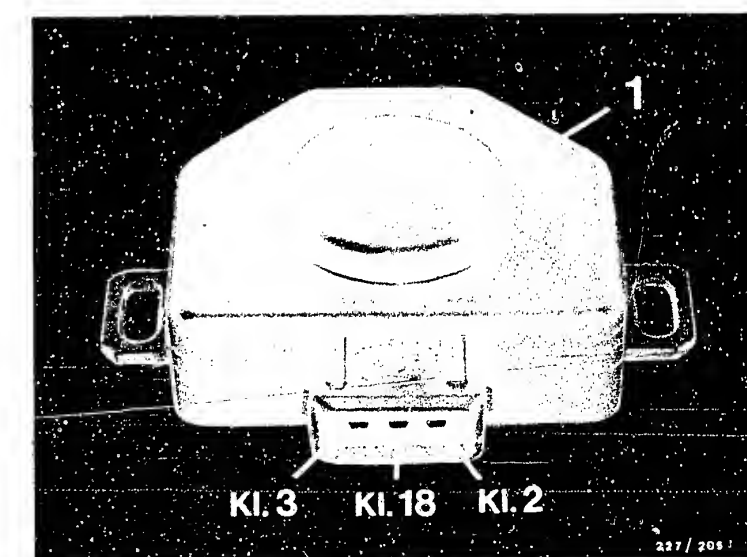
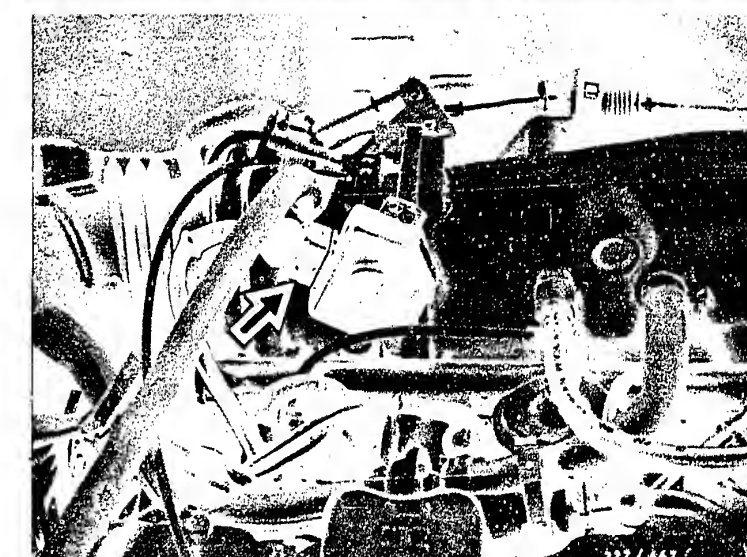
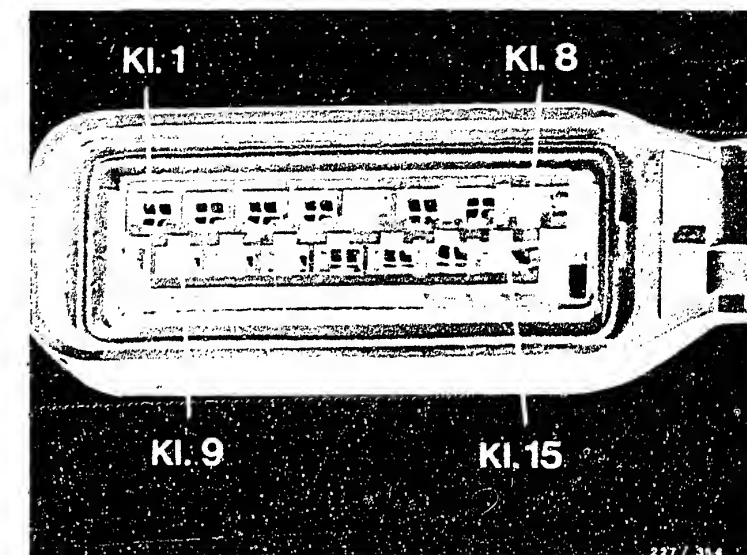
no

Disconnect throttle-valve switch plug. See arrow in centre picture.
Connect ohmmeter to throttle-valve switch term. 3 and term. 18.
See bottom picture.
Fully open throttle-valve.
Resistance reading approx. 0 Ω .
If resistance reading $\infty \Omega$.
Renew throttle-valve switch.

yes

Continued on C13/C14

Continued on C11/C12



C9

Trouble-shooting program

Opel



C10

Trouble-shooting program

Opel

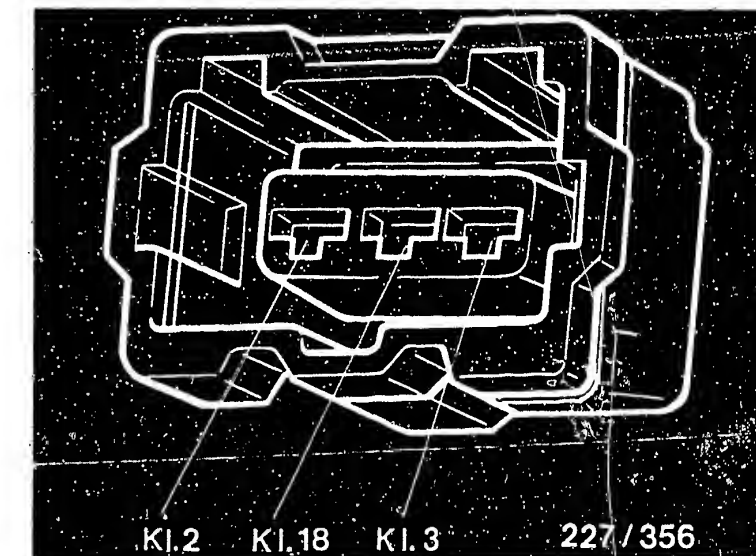
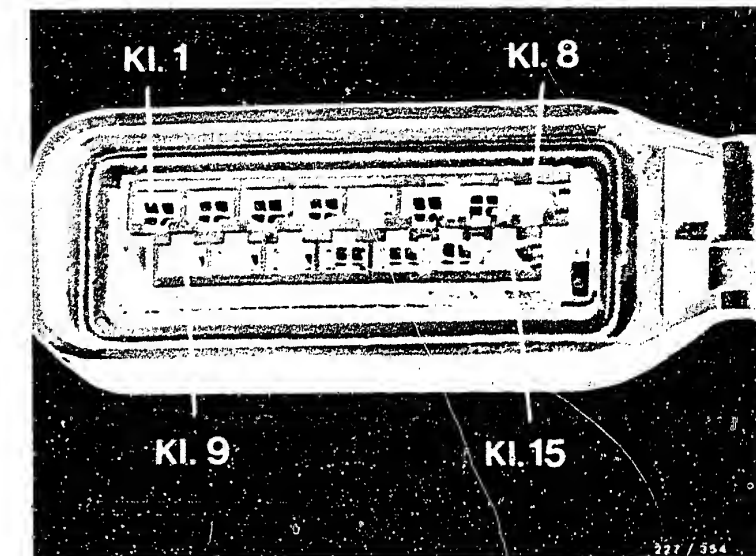


Continued

If approx. $0\ \Omega$ was measured, test for open circuit in cable connection from timing-advance unit plug term. 14 (top picture) to throttle-valve switch plug term. 3 (centre picture) and in cable from throttle-valve switch plug term. 18 to L-Jetronic control relay plug term. 87 (bottom picture). Eliminate open circuit.

yes

Continued on C13/C14



C11

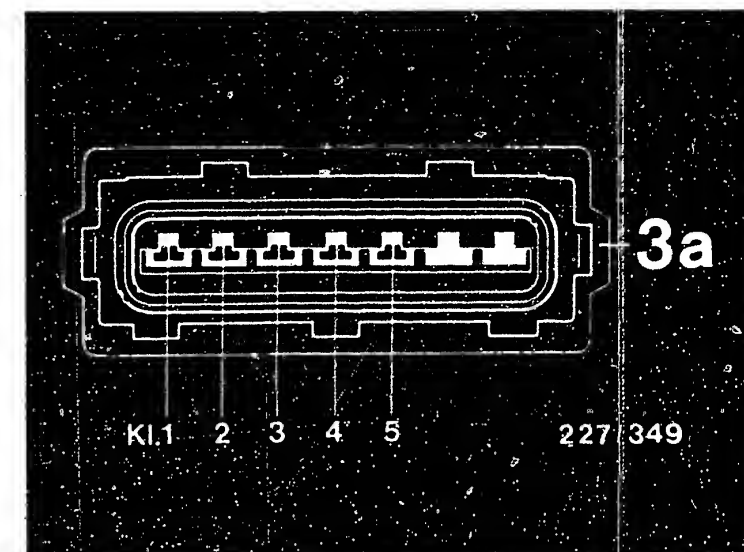
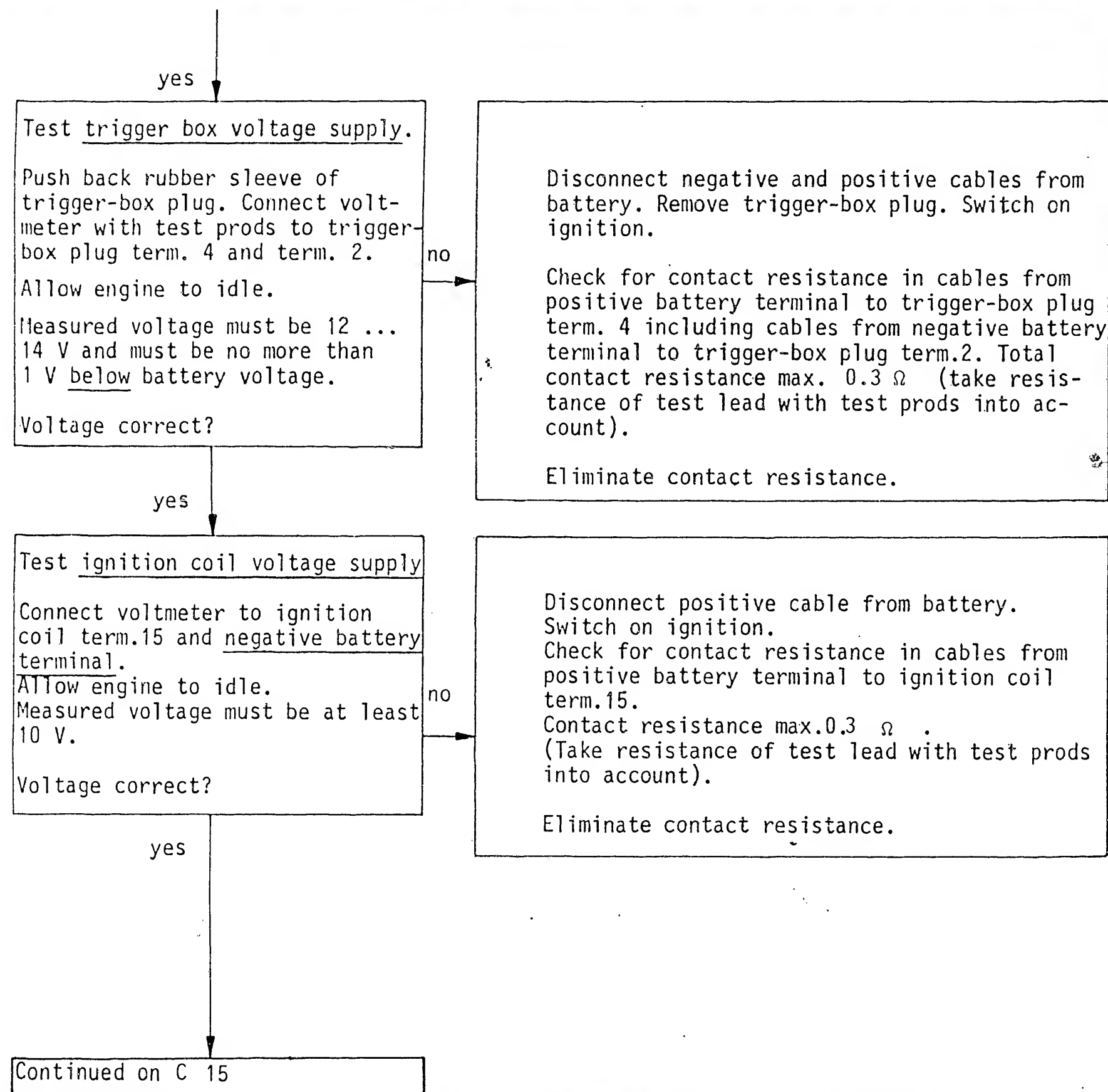
Trouble-shooting program
Opel



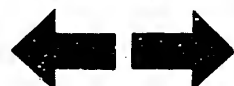
C12

Trouble-shooting program
Opel





3a = Trigger-box plug



yes

Ignition system O.K.

Test completed

Tests starting at D 1 no longer necessary.

Note:

If customer complaint is not yet remedied, then check for further possible faults in the fuel system, or engine not mechanically O.K.



No primary signal/no ignition spark
(Continued from B 9/B 10).

yes

Test trigger-box voltage subllly.

Remove trigger-box plug.
Connect voltmeter to trigger-box plug between
term. 4 (+) and term. 2 (-).
Switch on ignition.
Voltmeter must indicate battery voltage.

no

Check for open circuit in cables and
terminals from ignition and starting
switch to trigger-box plug term. 4
including ground cable term. 2.
Eliminate open circuit.

yes

Test primary circuit.

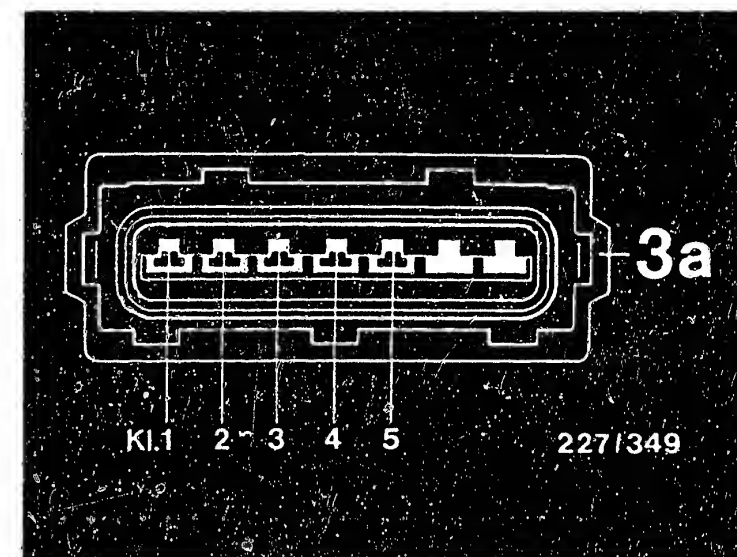
Connect voltmeter to disconnected trigger-box
plug between term. 1 (+) and term. 2 (-).
Switch on ignition.
Voltmeter must indicate battery voltage.

no

Check for open circuit in cable from
ignition and starting switch to igni-
tion coil term. 15, in the primary
winding of the ignition coil, in the
cable from ignition coil term. 1 to
trigger-box plug term. 1 and in the
ground cable term. 2.
Eliminate open circuit.

yes

Continued on D 3



3a = Trigger-box plug

D1

Trouble-shooting program

Opel

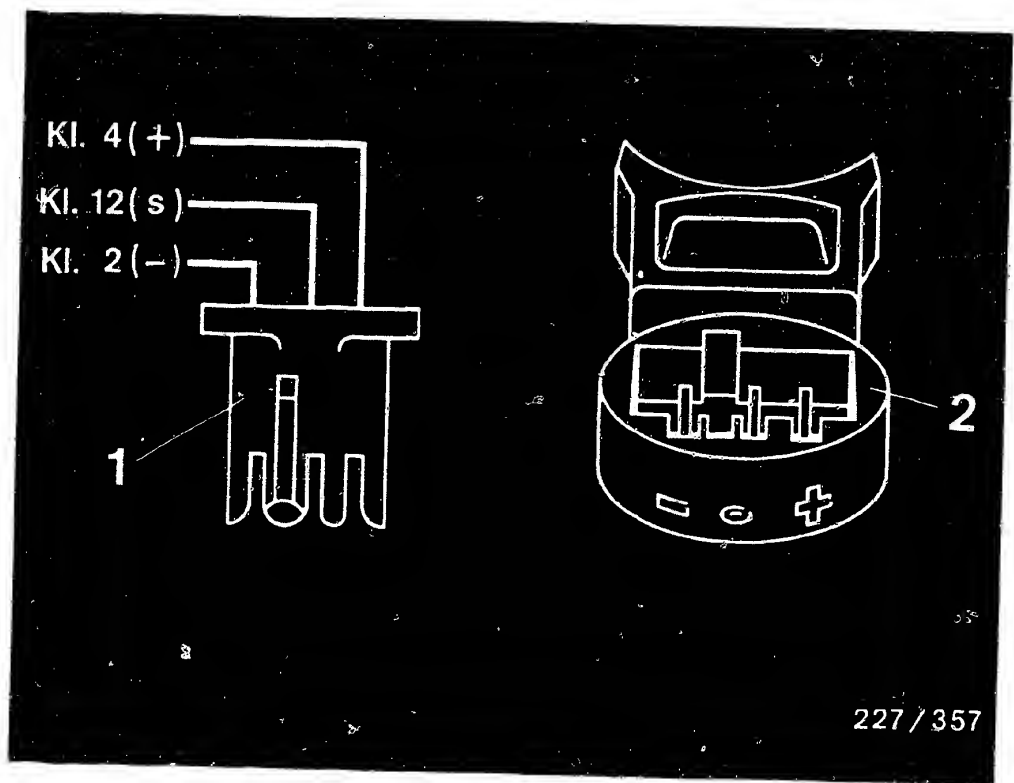


D2

Trouble-shooting program

Opel





1 = Ignition-distributor connector
2 = Ignition-distributor socket

yes

Test connector and socket of ignition distributor.

Visual examination:

Remove the ignition-distributor connector (see picture) and check contacts for oxidation and correct latching (remedy defects).

Reconnect ignition-distributor connector. If customer complaint not remedied, continue testing.

yes

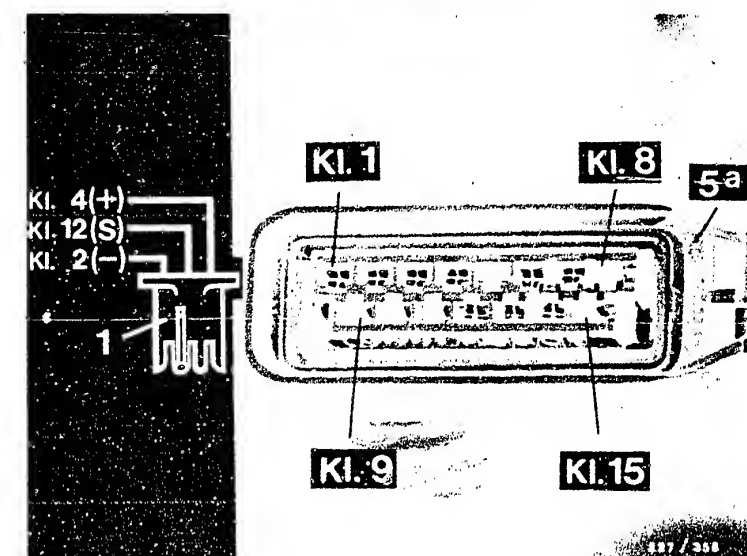
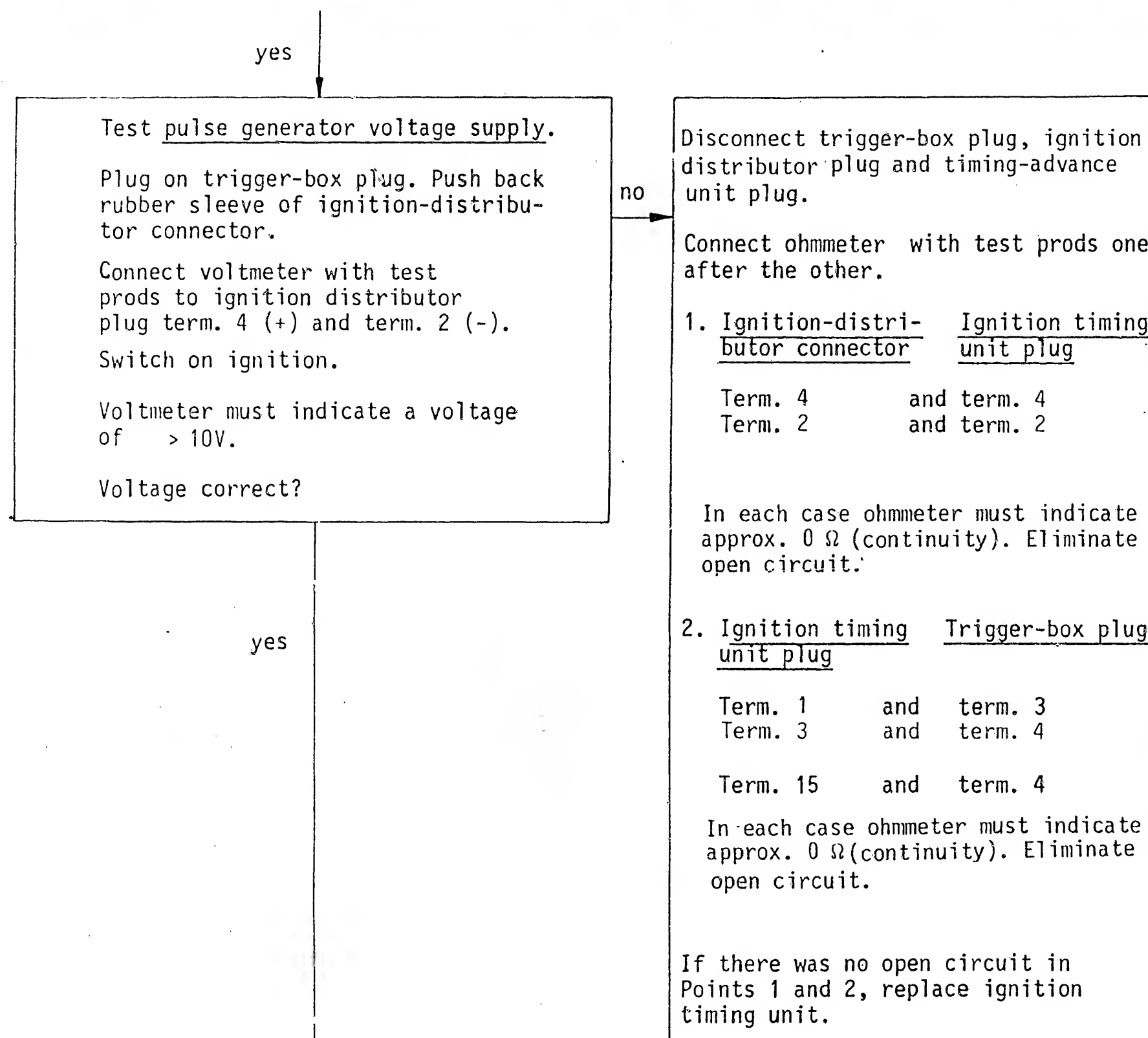
Continued on D 4 / D 5

D3

Trouble-shooting program

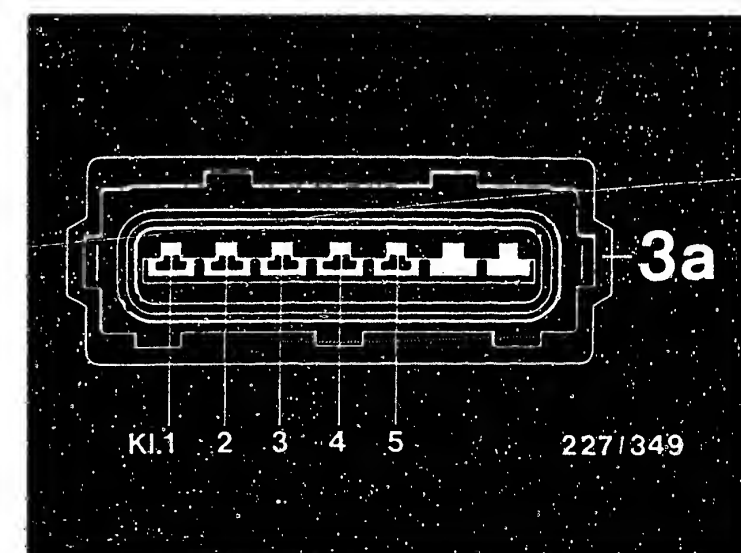
Open





1 = Ignition-distributor connector
5a = Ignition timing unit plug

3a = Trigger-box plug



D4

Trouble-shooting program

Open



D5

Trouble-shooting program

Open



yes

Test operation of pulse generator.

Trigger-box plug, ignition distributor plug and timing-advance unit plug connected.

Push back rubber sleeve of ignition-distributor connector.

Connect oscilloscope as per operating instructions with program switch in "special" position.

For example, MOT 201:

Red clip with test prod to ignition-distributor connector term. 12 (measured signal).

Black clip to ground.

Start engine.

The oscilloscope must show a rectangular pulse. See graph.

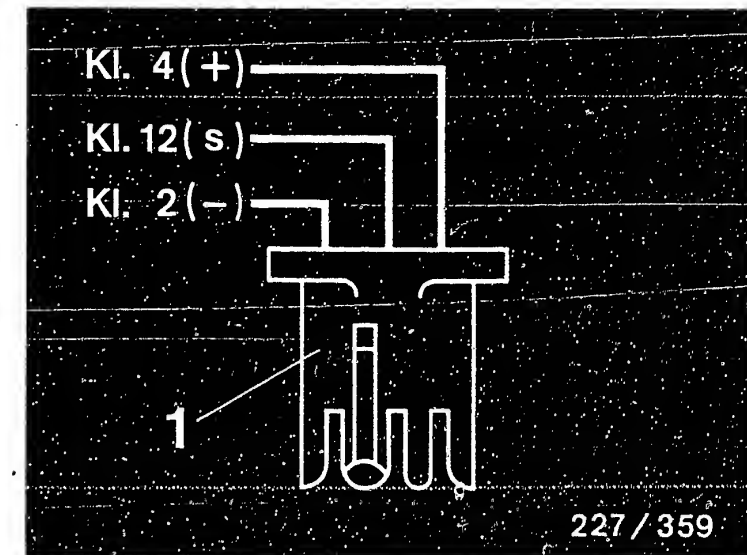
Rectangular pulse present?

no

Replace pulse generator/ignition distributor.

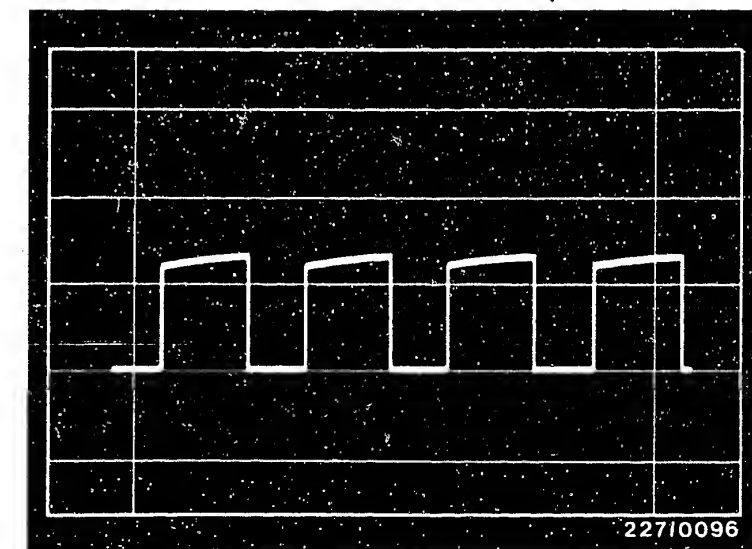
yes

Continued on D 8 / D 9



1 = Ignition-distributor connector

Rectangular pulse



D6

Trouble-shooting program

Opel



D7

Trouble-shooting program

Opel



yes

Test operation of pulse generator.

Trigger-box plug, ignition distributor plug and timing-advance unit plug connected.

Push back rubber sleeve of ignition-distributor connector.

Connect oscilloscope as per operating instructions with program switch in "special" position.

For example, MOT 201:

Red clip with test prod to ignition-distributor connector term. 5 (measured signal)

Black clip to ground.

Start engine.

The oscilloscope must show a rectangular pulse. See graph.

Rectangular pulse present?

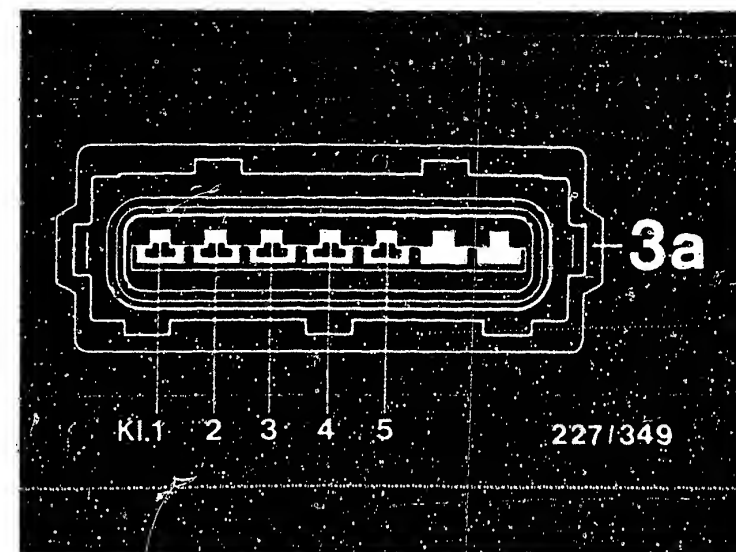
yes

Continued on D 12/D 13

no

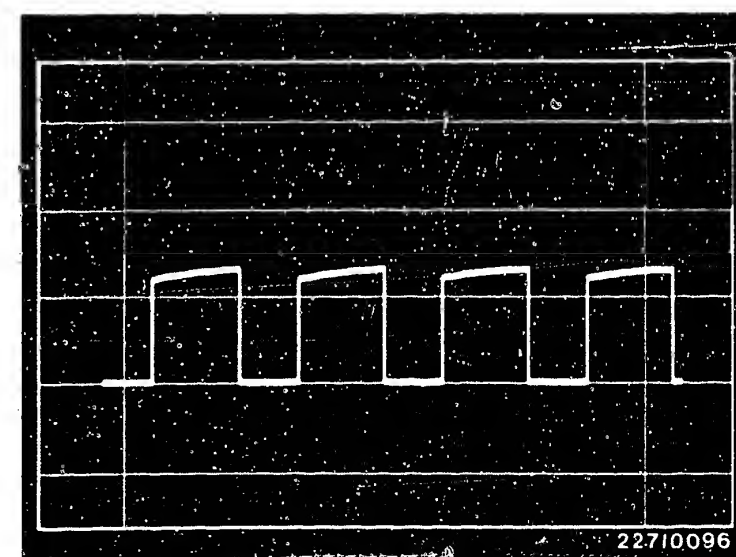
Disconnect trigger-box plug, ignition distributor plug and timing-advance unit plug.

Continued on D 10/D 11



3a = Trigger-box plug

Rectangular pulse



D8

Trouble-shooting program

Open



D9

Trouble-shooting program

Open



Continued

Connect ohmmeter consecutively to:

<u>Ignition-distributor connector</u>	<u>Ignition timing unit plug</u>
---	--------------------------------------

Term. 12 and term. 12

<u>Ignition timing unit plug</u>	<u>Trigger-box plug</u>
--------------------------------------	-----------------------------

Term. 13 and term. 5

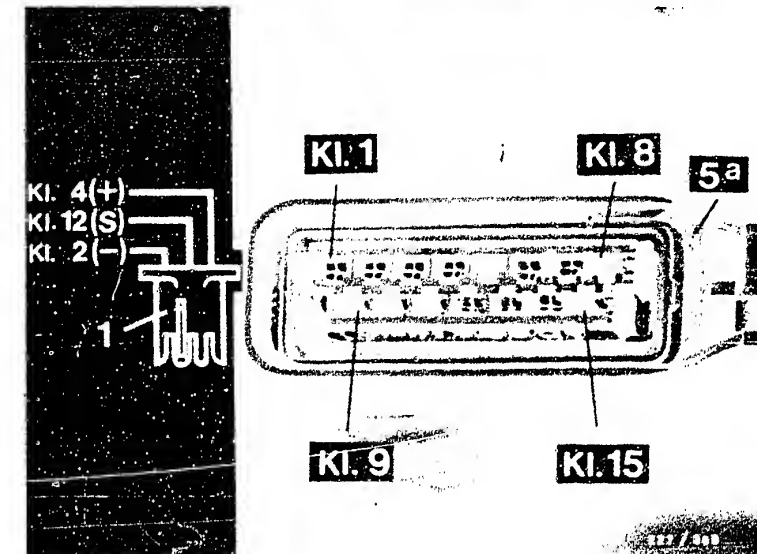
Ohmmeter must indicate continuity in both cases.

Eliminate open circuit.

If there was no open circuit, replace ignition timing unit.

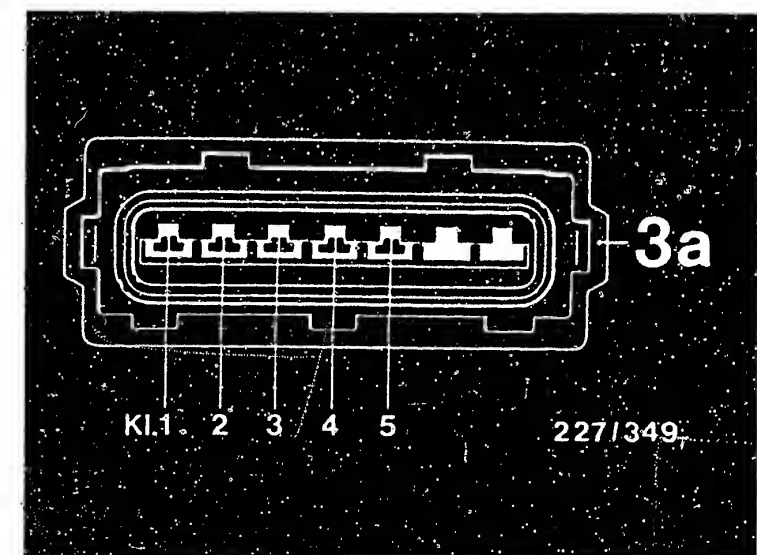
yes

Continued on D 12 / D 13



1 = Ignition-distributor connector
5a = Ignition timing unit plug

3a = Trigger-box plug



D 10

Trouble-shooting program

Open



D 11

Trouble-shooting program

Open



yes

Test ignition coil.

Visual examination:

Remove protective cap from ignition coil and check whether plug (see picture) is in position and whether any sealing compound has escaped.

Electrical test:

Ignition coil primary (term. 15 and term. 1) $0.6 \dots 1.0 \Omega$
(take resistance of test lead with test prods into account).

Ignition coil secondary (term. 1 and term. 4) $6.4 \dots 11.1 \text{ k}\Omega$

Plug in position? No sealing compound escaped?

Resistance value O.K.?

no

1. If plug is not in position and/or sealing compound has escaped, replace trigger-box, ignition timing unit and ignition coil.

2. If resistance values are not O.K., replace ignition coil.

yes

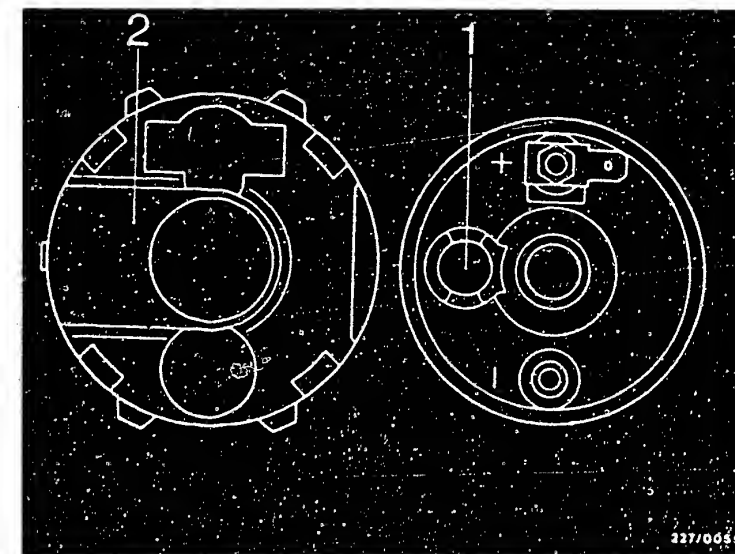
Replace trigger box.

Test completed.

Tests from B11 not necessary.

Note:

If customer complaint is not yet remedied, then check for further possible faults in the fuel system, or engine not mechanically O. K.



1 = Plug
2 = Protective cap

D12

Trouble-shooting program

Open



D13

Trouble-shooting program

Open



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Technical Bulletin

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22

Danger of Accident on Semi-conductor Ignition Systems

VDT-I-227/102 B

11.1976

Please be sure to pass this bulletin on to your employees for their attention.

The increased demands made on their ignition systems by modern engines, and the wish for freedom from maintenance, led some time ago to manufactures starting to equip their vehicles with semi-conductor ignition systems as original equipment. In most cases the performance of nearly all makes of such systems is higher than that of conventional systems, and further improvements are to be expected. This means that semi-conductor ignition systems have reached the point where contact with "live" parts or contacts (whether on the primary side or the secondary side) can prove fatal.

In this connection we should like to point out to you that the laws valid in your country regarding work on high-voltage systems must be adhered to when working on, or testing, semi-conductor ignition systems.

As a matter of principle, when working on such ignition systems the ignition is to be switched off. Included in such work are the following operations:

- Connection of engine testing equipment (timing light, dwell-tach tester, ignition oscilloscope etc.).
- Replacement of ignition system parts (spark plugs, ignition coil, ignition distributor, H.T. ignition cables etc.).

If it is necessary to switch on the ignition in order to test the system or make adjustments on the engine (to the carburetor for instance), then lethal voltages are present throughout the entire system.

This means that the danger of accident exists not only at individual components in the system (e.g. ignition distributor, ignition coil, trigger box, ignition harness), but also at the wiring harness (e.g. connection for the tachometer, diagnostic connector), at terminals, and on test equipment.

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N1

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Opel

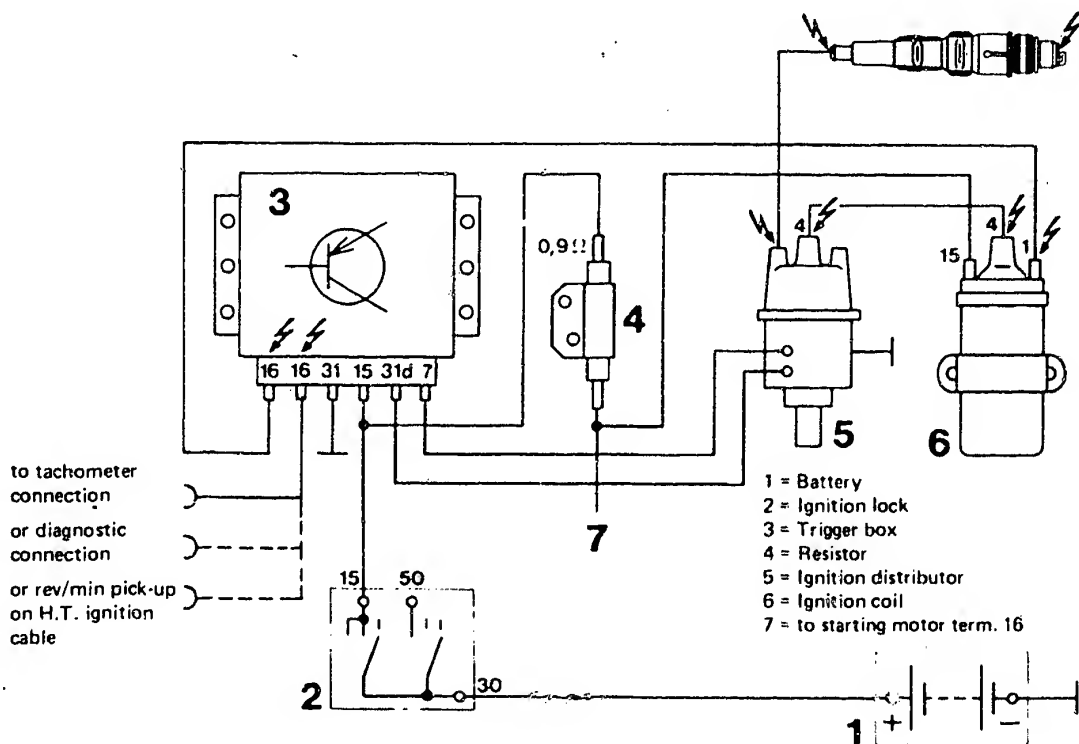


In addition, in the case of the capacitor-discharge ignition system (CDI), danger of accident is also present under the following circumstances:

- Operation of the trigger box without the ignition transformer.
- At the trigger box, (removed), relatively soon after it has been switched off (capacitor discharge).

Below is a typical terminal diagram of a semi-conductor ignition system, the danger points are marked with red high-voltage arrows. We would point out that all semi-conductor ignition systems, even the older ones, are to be regarded as dangerous in the sense as defined by this bulletin.

Please address any queries or comments concerning the contents of this publication to our representative in your country.



Terminal diagram



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EFFECTS OF ELECTRICAL AND ELECTRONIC
SYSTEMS ON HEART PACEMAKERS

VDT-I-227/107 En

1.1981

e.g. ignition systems, Jetronic, Motronic, ABS

Please ensure without fail that this Bulletin is passed on to your employees for their attention!

We have often been asked by some of our customers whether or not patients with heart pacemakers are endangered in any way by ignition systems. This theme was recently the subject of an examination carried out by the Ignition System Development Department of Robert Bosch GmbH in conjunction with Dr. Thull, lecturer at the Central Institute for Biomedical Technology at the University of Erlangen-Nürnberg and Biotronic GmbH & Co. of Berlin, a manufacturer of heart pacemakers. The magazine "Biomedizinischen Technik" (5/80) listed the results.

The most important discoveries in this practice can be summarized from the examination report as follows:-

1. Heart pacemakers corresponding to the latest state of the art are not affected by radiation (electromagnetic fields) from ignition systems.
2. With a stationary engine and the ignition switched off the heart pacemaker is not affected by any part of the ignition system, even when unintentionally touched. Maintenance work in the engine compartment, for example, can then be carried out without any danger.
3. With the engine running or stationary with the ignition switched on, touching current-carrying parts of the ignition system, as well as parts of any other electrical system, presents a certain danger for everybody. The heart pacemaker can here be affected under certain conditions (voltage, current and frequency). Patients with heart pacemakers should therefore at all costs avoid touching current-carrying parts of electrical systems.
4. Furthermore, patients with heart pacemakers are more inclined to psychic shock effects than other people, even when they receive just a harmless electric shock, because many such patients are conscious of the increased danger to the cardiac activity.

We therefore consider it inadvisable for patients with heart pacemakers to be employed in workshops or on vehicles where ignition systems are being tested or repaired. If any members of your staff have heart pacemakers please carry out the necessary measures.

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We would like to add that heart pacemakers are not expected to be affected in any way by interference from other electronic products and systems which we manufacture, such as the Antiskid System (ABS), Jetronic, Motronic, because the much greater radiation intensity of the ignition systems examined in normal use has not caused any interference to heart pacemakers corresponding to the latest state of the art.

If you should receive questions on this matter from customers, please inform them accordingly.



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BREAKERLESS TRANSISTORIZED IGNITION SYSTEM

22

Warranty note

VDT-I-227/103 En
3.1979

Hybrid construction trigger boxes
0 227 100 100 for ignition distributor
with Hall generator (TCI-h)
0 227 100 102 for ignition distributor
with induction-type
pulse generator (TCI-i)

Apart from the well-known TCI trigger boxes 0 227 100 0.., trigger boxes of hybrid construction have been fitted as standard since 9.78 (Fig. 1).

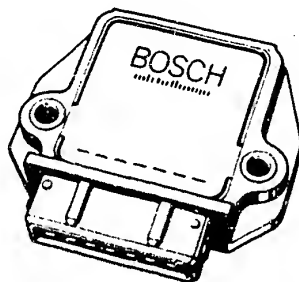


Fig. 1

Warranty procedure

If the complaints are justified, all these hybrid trigger boxes are to be sent, along with completed warranty documents, to your authorized representative for forwarding to the following address:

ROBERT BOSCH GMBH
KH/LAV - Auspackraum

zur Weiterleitung an K1/VAK 21

D-7000 Stuttgart 30

This instruction remains valid until further notice.

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NEW DESIGNATIONS FOR IGNITION SYSTEMS

VDT-I-227/108 En

1.1983

The introduction of new ignition systems has made it necessary to reclassify all designations.

The designations listed below will be used immediately in KH workshop and sales literature.

Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Coil ignition	SZ (CI)	-----	Mechanical (breaker points)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized coil ignition	TSZ-K (TCI-c)	K=breaker-triggered	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Trigger box with conventional circuit techniques	TSZ-I* (TCI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
	TSZ-H	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
Transistorized ignition	TZ-I* (TI-i)	I=Induction-type pulse generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)
(Trigger box in Hybrid technique)	TZ-H* (TI-h)	H=Hall generator	Electronic (trigger box)	Mechanical (ignition distributor)	Mechanical (ignition distributor)

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Designation	Abbrev'd code	Meaning	Switching	Ignition control and spark advance	High-voltage distribution
Breakerless semiconductor ignition with or without knock control	EZ EZ-K	- K=Knock control	Electronic (trigger box or control unit)	Electronic (control unit)	Mechanical (ignition distributor or high-voltage distributor)
Distributorless ignition with or without knock control	VZ VZ-K	- K=Knock control	Electronic (control unit)	Electronic (control unit)	Electronic (dual-spark ignition coil, or 1 ignition coil for each spark plug)

*Note: The ignition system can also be equipped with a DLS unit (digital idle stabilization) or with an ELS unit (electronic idle stabilization) or with an ESV unit (electronic ignition retardation).



After-sales Service

Motor Vehicle Service Information

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INCORRECT DISPLAY OF ROTATIONAL SPEED AND
DWELL ANGLE ONLY WITH TRIGGER BOXES
0 227 100 ... (TCI-i, TCI-h) WITH CURRENT
LIMITATION

VDT-I-Gen. 030 En
6.80
Supersedes Ed. 3.80

For additional information see VDT-I-Gen. 032 En

1. General

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle when testing the ignition system. However, there is no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Incorrect displays may occur with the testers listed below:

MOT 001.00 }	Rotational-speed	KTE 001.00
001.01 }	display O.K. with these	001.02
001.02	testers	001.03
001.04		
002.00		

By now, the following vehicles may be fitted with breakerless ignition systems with current limitation:

Audi	(Bosch/Fairchild-ignition system)	Mazda	(Mitsubishi ignition system)
Bmw	(Bosch ignition system)	Mitsubishi	(Mitsubishi ignition system)
Citroen	(Delco ignition system)	Nissan-Datsun	(Hitachi ignition system)
Fiat	(Delco ignition system)	Peugeot	(Bosch ignition system)
Ford	(Delco ignition system)	VW	(Bosch/Fairchild ignition system)
General-Motors	(HEI-ignition system)	Bosch transistorized ignition system for retrofitting 0 227 100 920	

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Service Information

Opel



2. Test instructions

2.1 Rotational speed

Incorrect rotational-speed display can be recognized as follows:

If one starts at the idle speed and slowly increases the engine speed, then the incorrect display can be recognized by an abrupt reduction in the rotational-speed display (e.g. from 2400 min⁻¹ to 1200 min⁻¹).

It is, however, possible to attain correct rot.-speed measurements as follows:

Connect a ballast resistor of 0.9 or 1.0 Ohm (see Fig.) in series in the line to term. 15 of the ignition coil (take care not to cause a short circuit). After the rotational-speed measurement, the ballast resistor must be removed (otherwise starting difficulties and misfiring). Connect tester as per operating instructions.

Suggestion for user manufacture

Required parts:

- 1 ballast resistor 0.9 Ohm
- or
- 1 ballast resistor 1.0 Ohm
- 2 blade receptacles e.g.
- approx. 0.2 m cable, 1.5 mm² e.g.
- 2 insulated clips

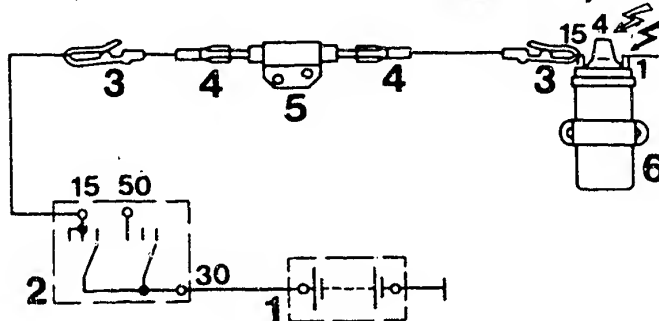
Part No. 0 227 900 002

Part No. 0 227 900 101

Part No. 1 901 355 881

Part No. 6 210 150 150

Commercially available



- 1 = Battery
- 2 = Ignition switch
- 3 = Clips

- 4 = Blade receptacle
- 5 = Ballast resistor
- 6 = Ignition coil

⚡ approx. 400 V

⚡ approx. 25 kV

2.2 Dwell angle

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.

2.3 Ignition point

Is displayed correctly. Connect tester as per operating instructions.



After-sales Service

Motor Vehicle Service Information

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MOTORTESTER CONVERSION

VDT-I-Gen. 032 En
6.80

Incorrect display of rotational speed,
dwell angle and ignition point
only with trigger boxes.
0 227 100 ... (TCI-i, TCI-h) with current
limitation

For additional information see VDT-I-Gen. 030 of 6.80

Re.: Motortester EFAW 268
268 S 10
269
214 B
AE 2000

1. General

Please make sure that the above-mentioned motortesters in your workshop and at your customers (e.g. motor vehicle workshops, oil companies, gas stations, vocational schools etc.) are converted. The conversion is subject to payment and is carried out by the K7 after-sales service of the responsible BG. The standard time is 15 work units (with fitting of switch).

2. Why motortester conversion?

In comparison with conventional ignition systems, transistorized ignition systems with current limitation have different primary voltage characteristics. During the dwell period the voltage at terminal 1 of the ignition coil may assume values from 1.5 V to battery voltage (or greater). This may lead to an incorrect display of rotational speed and dwell angle as well as to incorrect triggering of the meter when testing the ignition system. There is, however, no functional defect in the ignition system, and, for this reason, the trigger box must not be replaced. Since, with the above-listed motortesters, the timing light is triggered by the signal path dwell angle - meter, this incorrect triggering also leads to incorrect flashing and thus to an incorrect display of the advance angle.

3. Conversion measures

The situation is to be remedied by modifying the wiring of the testers so that the timing light is triggered by the clamp-on induction pickup and the pulse shaper stage.

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Service Information

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4. Test instructions

4.1 Standard ignition systems

Switch position: "standard"

All other tester connections as per operating instructions.

4.2 Ignition systems with current limitation

Switch position: "current limitation"

In order to trigger the timing light, the induction-type pulse generator (clamp-on pickup or red pickup) must always be connected during the measurement.

The selector switch for ignition systems built into the motortester must be switched to standard coil ignition (not to TCI) with these ignition systems.

All other tester connections as per operating instructions.

The dwell angle is electronically controlled. A measurement of the dwell angle is no longer performed.



After-sales Service

Motor Vehicle Service Information

Only for use within the Bosch organization. Not to be communicated to any third party.

TESTS ON ELECTRONIC IGNITION SYSTEMS
(TCI, TZ)
TESTER INSTRUCTIONS

VDT-I-Gen. 035 En.
3.1981

The following tests are listed in older and current Tester operating instructions or in Trouble-shooting with the oscillograph:

- "Separate ignition coil test" (concerns EFAW 213, 214, 268, AE 2000).
- "Calculating the "ignition voltage reserve" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).
- "Intensified insulation test" (concerns EFAW 213, 214, 268, AE 2000 and MOT series).

Nowadays transistorized ignition systems deliver more than 30,000 V secondary voltage.

To avoid damage to ignition coil, ignition cable and ignition distributor by voltage flashovers, the tests listed above should not be carried out on transistorized ignition systems.

The contents of this Service Information has already been published in the K7-Information K7-VJF 17/8012.

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